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B.J. GILL and N.J. PRICKETT

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# PAKEHA AND MAORI FORTIFICATIONS OF THE FIRST TARANAKI WAR, 1860–61

NIGEL PRICKETT

*Abstract.* In the First Taranaki War of 1860–61 small field works thrown up by both sides were central to the conduct and course of the fighting. Maori works included *ca* 30 fortified pa, also rifle pits and trenches. Thirty-one Pakeha forts were earthwork redoubts, stockades or blockhouses. Archaeological remains of the sites make up an important part of the north Taranaki historic landscape.

It was a major part of Maori strategy to erect fortified pa to invite attack. By this means the enemy would be defeated and the conflict brought to an end. A notable success was achieved at Puketakauere in June 1860, otherwise the strategy was to prove indecisive.

European forces used fortifications to gain battlefield advantage, protect lines of communication, and defend civilian and troop concentrations. The success of the works was measured not by their having repelled an attack but by none having been attempted. The campaign saw the first major use of field fortifications by Pakeha forces in the New Zealand Wars, and their only sustained use in tactical battlefield roles.

The 19th century New Zealand Wars were critical in changing New Zealand from a predominantly Maori country to one in which the Pakeha prevailed. Campaigns in the 1840s did little to resolve conflict between the indigenous people and newcomers, but from 1863, fighting in the Waikato, Bay of Plenty, Wanganui and Taranaki districts altered the balance of power between the races and secured much of the North Island's richest land for Pakeha settlement. Between these two phases of military conflict was the Taranaki war of 1860–61. In its lack of resolution this was like the earlier campaigns. In the extensive use of small field fortifications by both sides it set an example for fighting which followed.

In the main part of this account the description and history of fortifications is organised chronologically. It is hoped that the reader will thus be able to follow the course of the campaign and understand the purpose and context of the various works.

## TARANAKI

From the start of organised Pakeha settlement in Taranaki in 1841 a conflict arose between Maori and European over land (see Fig. 1). The newcomers were frustrated by the Maori refusal to sell; and Maori undoubtedly felt threatened by the growing Pakeha presence. The conflict reached a new stage in 1859 when a chief named Teira offered land at Waitara to Governor Gore Browne who was visiting New Plymouth.

Pakeha settlers eagerly grasped the opportunity to break up opposition to land sales among the Te Atiawa iwi (tribe), and to extend their settlement in a long desired direction. But

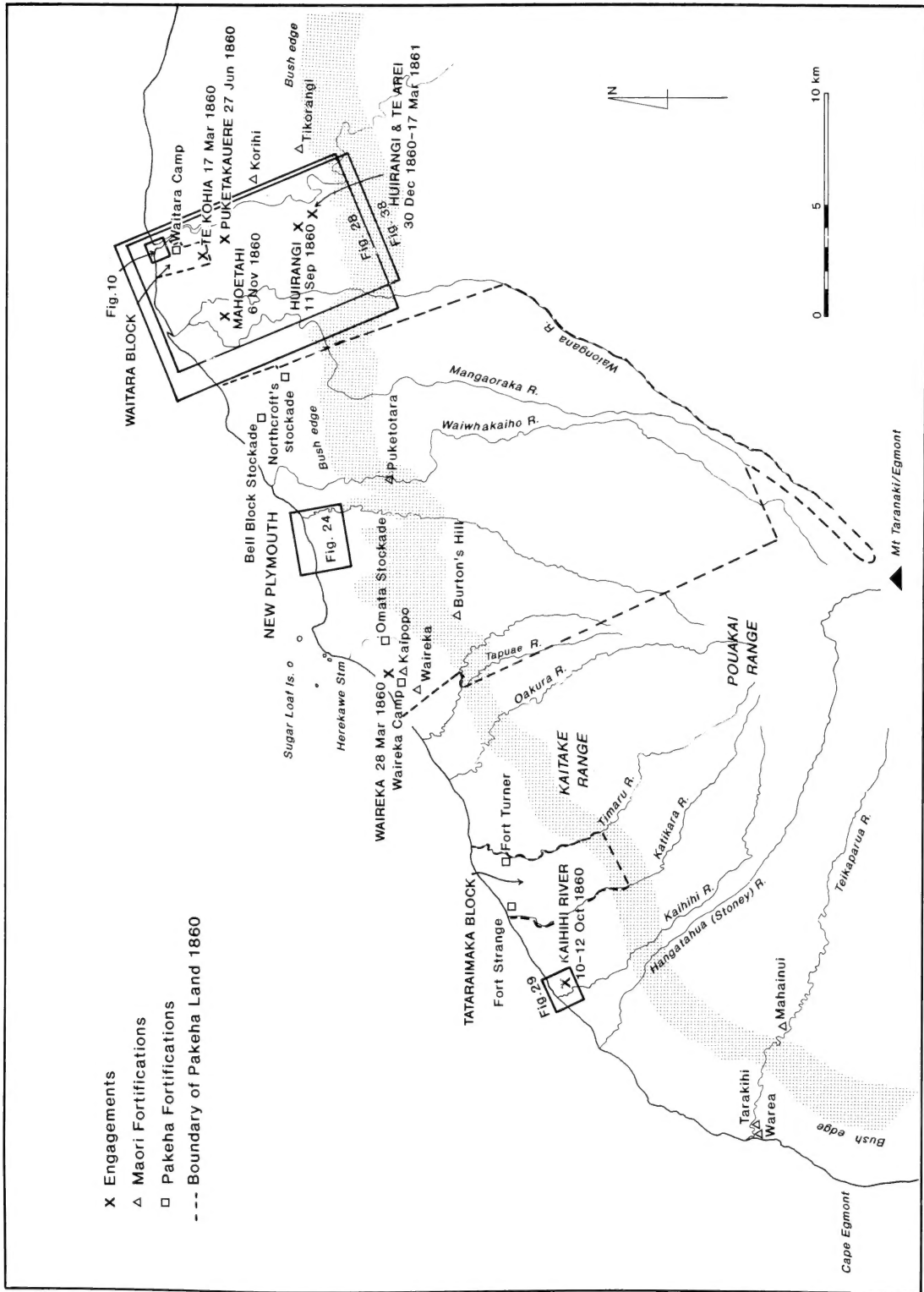


Fig. 1. North Taranaki, showing location of Figures 10, 24, 28, 29 and 38, also Maori and Pakeha fortifications outside the detailed maps, major engagements, purchased land, forest edge, rivers and streams, etc.

the sale of Waitara was opposed by the greater part of Te Atiawa under the leadership of Wiremu Kingi te Rangitake. In February 1860 surveyors began marking out the disputed land. When they were obstructed by Maori people living there martial law was declared on 22 February. Work on settler forts in farming districts north and south of New Plymouth was rapidly pushed ahead.

The First Taranaki War took place from March 1860 to March 1861. Throughout the campaign the British command sought a decisive victory over Maori forces. This was the proper way to conduct warfare after all, and somehow Waitara would be secured as a result. The problem was that the enemy would not come out and fight. Pakeha forces were thus drawn into attacks on fortified pa, with mixed success and little strategic benefit.

Early in the war Governor Browne advised Taranaki commanding officer Colonel Gold on just how this should be done. He refers to Wiremu Kingi a few days before the fight at Te Kohia in March.

"I suggest also for your consideration whether it might not be desirable to let him complete his pah, and (when you have information that his men are all there) summon him, give him a few minutes warning, and if he does not lay down his arms, and submit himself to you, storm the pah, and take it, using every possible caution, which will not be found unnecessary."

(GBPP 1861:16–17)

Ahead there was a considerable learning experience.

The First Taranaki War had more in common with campaigns of the 1840s than with those which followed. At the war's end European forces held Waitara, but had lost the larger Tataraimaka Block south of New Plymouth, in Pakeha hands since it was purchased from the Taranaki iwi in 1847. The great issues between Maori and Pakeha were unresolved.

The 1863 New Zealand Settlements Act ('Confiscation Act') brought Pakeha military strategy into line with colonial ambition. This allowed the confiscation of land from Maori tribes, any section of which was in rebellion against the Crown. Henceforth the military struggle and land issue alike were to be resolved by dispossessing the Maori and placing Pakeha settlers on confiscated land.

The 1860–61 war may be divided into four seasons of varying fortune. The March 1860 occupation of Waitara by troops was followed by engagements at Te Kohia and Waireka and the Pakeha attempt to hold Tataraimaka. In winter there was Maori success at Puketakauere, Pakeha abandonment of Tataraimaka, the entrenchment of New Plymouth and the stand-off on Waireka Hill. In spring Pakeha forces again campaigned south and north of New Plymouth, to gain their first success at Mahoetahi in November. In summer the war was fought out at Waitara. A ceasefire was arranged in March 1861.

The interest here is on fortifications, but it must not be thought that military activity was focussed only on these works. A major part of Maori and Pakeha campaigning was directed towards the destruction of property and the means of subsistence of the enemy. In this Maori were probably the more successful. Their style of campaigning was more suited to quick raids and Pakeha farms were easily accessible from surrounding bush. The Omata settler Thomas Grayling (1862:108–112) lists 177 Pakeha homesteads burnt during the war. The location of

most of them is marked on Octavius Carrington's 1862 map, "New Zealand Province of Taranaki from Waitara to Oeo".

## THE FIELD

The region over which the war was fought is part of the Mt Taranaki (Egmont) ring plain of generally level or easy terrace country. Swift rivers and streams radiate to the sea from the mountain and its outlying ranges. In the north the Waitara River emerges from forested hill country not yet explored by Pakeha settlers in 1860. At New Plymouth vessels moored in the open roadstead, lighters working off the exposed beach. Small vessels were able to enter the shallow Waitara River mouth.

The rivers made transport difficult for troops whose bullock and horse carts were forever having to descend into river beds of stones and boulders. This was especially so south of New Plymouth where elevated terrace country was cut by deep river valleys. In winter rivers often flooded, as, for example, the Waiongana which Colonel Gold claimed would not allow him to go to the assistance of the Major Nelson at Puketakauere where British troops suffered their major defeat of the war. Everywhere rain quickly turned the light volcanic soil – and roads – into slush.

Beyond Omata the road was by way of the beach, ascending to the coastal terrace where an easier route was offered. Behind the narrow coastal plain are the steep spurs of the Kaitake Range. North of New Plymouth a cart road extended as far as Waitara across mostly flat country with few difficult climbs and descents. Here the coastal plain is narrow near the town and 7–8 km wide at the Waitara River.

An exception to the terrace country is the 100 m high Tapuae Ridge which reaches the coast in the Omata district, south of New Plymouth. With extensive views north and south it was a preferred location for Maori and Pakeha fortifications in the First and Second Taranaki Wars. This is the western end of high ground which continues behind the coastal plain to the Waitara River and beyond. Roughly coinciding with the bush edge, the escarpment offered elevated locations for Maori fortifications backed by good escape routes.

Where it was not brought under cultivation by Maori or Pakeha the coastal plain was largely covered in bracken as much as 2 m high. This was the ever-present environment for troops and Maori once they ventured off the cart roads and walking tracks. Tutu was common, with occasional groves of rewarewa, karaka and other broadleaved native trees, especially in the river valleys.

Away from the coast the hill country was clothed in dense broadleaf and podocarp rainforest. The Maori employed routes through the forest for access to fighting fronts. The troops did not venture into forest in the war of 1860–61. In the Omata, Bell Block and Tataraimaka districts fighting took place in a landscape already largely modified by European farming. Maori and Pakeha took cover behind gorse hedges; Maori demolished farmhouses to re-use the material in rifle pits and other works.

## THE FORCES

Pakeha troop numbers in Taranaki at the beginning of the First Taranaki War numbered *ca* 400 officers and men (Carey 1863:18), mostly 65th (Yorkshire North Riding) Regiment of Foot. The 65th had provided the New Plymouth garrison since 1856 – and after the departure of the 58th Regiment in 1858 were the only troops in New Zealand. In early 1860 there were also 23 Royal Artillery and 12 Royal Engineers at New Plymouth.

Throughout 1860 a number of other regiments were ordered to New Zealand, those taking part in the war being the 12th (East Suffolk) Regiment of Foot, the 14th (Buckinghamshire) and 40th (Somersetshire) Regiments – also the 57th (West Middlesex) Regiment, which arrived from India in January 1861 and stayed on as garrison in Taranaki after the campaign.

When General Pratt arrived in New Plymouth in August 1860 Pakeha forces in Taranaki totalled 2627 all ranks, two-thirds of them regimental troops and the remainder Naval Brigade and local forces made up of Taranaki Militia and Taranaki Volunteer Rifles (Carey 1863:44–46). Captain Pasley, Royal Engineers, who arrived with Pratt gives numbers through the latter half of 1860 and January 1861 (Pasley 1863:593). Effectives were 2000 in spring, falling to 1500 with the departure of troops for Auckland in November, rising again to 2600 in the New Year with the return of men from Auckland and arrival of the 14th and 57th Regiments.

Some Te Atiawa and Taranaki Maori fought alongside the troops. Maori fighting alongside Pakeha are numbered in reports of military movements. An example is Pratt's report on the October 1860 expedition to Kaihihi River where his force is said to comprise nearly 1000 Pakeha and 150 Maori (GBPP 1861:165).

Estimates of opposing forces are difficult because of inflated Maori numbers in enemy reports. At Puketakauere on 27 June 1860 a Maori figure gives 400 fighting men (Grayling 1862:93). In this case they were mostly Te Atiawa and Waikato, with smaller groups from half-a-dozen other tribes. At Mahoetahi on 7 November 1860, Pakeha forces totalling almost 1000 were ranged against perhaps 150 Ngati Haua and Waikato (Grayling 1862:93). South of New Plymouth, Taranaki, Ngati Ruanui and other southern tribes were not always outnumbered by Pakeha forces when they took to the field. In August 1860 250 troops at Waireka Hill confronted as many as 400 Maori dug in on the ridge to the south.

Throughout the war Maori forces were mostly local, with distant tribes sometimes strongly represented as at Mahoetahi, and increasingly in early 1861. Pasley (1863:571) gives a figure of 1700–1800 Maori in arms in north Taranaki in early August 1860. Half were Te Atiawa and “Waikatos” (the Tainui tribes of Waikato and Ngati Maniapoto) in the Waitara district, and half Taranaki and Ngati Ruanui at Waireka. The historian James Belich (1986:102–103) suggests that Waikato numbers peaked at 800 in January 1861. Native Secretary Donald McLean estimated 1200 Taranaki and Ngati Ruanui in the field at the end of August 1860, of which perhaps 800 were fighting men (GBPP 1861:126).

Before the war Maori lived in small kainga or villages, some of them fortified as pa especially north of New Plymouth where there was fighting among Te Atiawa in the 1850s. Outside the town Pakeha were scattered on their farms, with only one small village and hotel

at Omata. In 1859 Pakeha in Taranaki numbered 2700. In the same year the Maori population of the province was 3015, including 1385 men over 14 years of age (Fenton 1859).

## THE COURSE OF WAR

### THE TROOPS ARRIVE

British troops were first sent to New Plymouth in 1855 to reassure Pakeha settlers confronted by conflict among Maori tribes. Acting-Governor Wynyard sent from Auckland 250 men of the 58th (Rutlandshire) Regiment with a proportion of Royal Artillery and Royal Engineers. They arrived on 19 August in the *Duke of Portland*. Landing the troops, along with 200 tons of military stores, two 24-pounder howitzers and a “field piece”, took place from 19 to 22 August. On the 24th the *Duke of Portland* sailed for Wellington to bring up troops of the 65th Regiment, the major part of which arrived on 6 September (Scholefield 1960 I:177).

Major C.L. Nugent in command of the detachment, wrote to the Major of Brigade, Auckland, on 31 August,

“The weather for the last six days has been wet, and I have consequently been unable to shift the encampment from its present place, “Mount Eliot,” to a more fitting spot which I have selected, adjacent to Marsland Hill.

The cutting down of Marsland Hill is proceeding with rapidity, and it will soon be in readiness for the reception of the iron barracks, if it is intended to place them thereon. I think, however, a more eligible situation might be selected.”

(GBPP 1860)

The arrival of the 65th from Wellington increased the garrison to 500 men. By March 1856 the 58th had departed. Troops of the 65th Regiment under Major G.F. Murray then remained as garrison in New Plymouth until reinforcements arrived following the outbreak of war in early 1860.

### *Mt Eliot*

Mt Eliot was the name given to a high point of land – and pre-European pa, Pukeariki – south of the Huatoki Stream mouth, overlooking the landing place near the centre of New Plymouth. In the 1840s and 50s the site was occupied by government buildings and a signalling station for ships using the open roadstead.

When the troops first arrived they camped here in tents. Fortification involved throwing up an earth breastwork around the top of the hill to enclose the existing signal mast and buildings. Mt Eliot provided a barracks for many years, as well as being a key strong point when the town was entrenched during the First Taranaki War. In the war of 1860–61 the Naval Brigade was in residence.

A contemporary pencil sketch shows the earth and timber defensive works, with signal mast, tents and building within the fort (Fig. 2). Mt Eliot is also depicted in a watercolour by Colonel H.J. Warre in the Rex Nan Kivell collection, National Library of Australia, Canberra (reproduced in Prickett 1981:27). His view looks across the Huatoki Stream mouth to the main



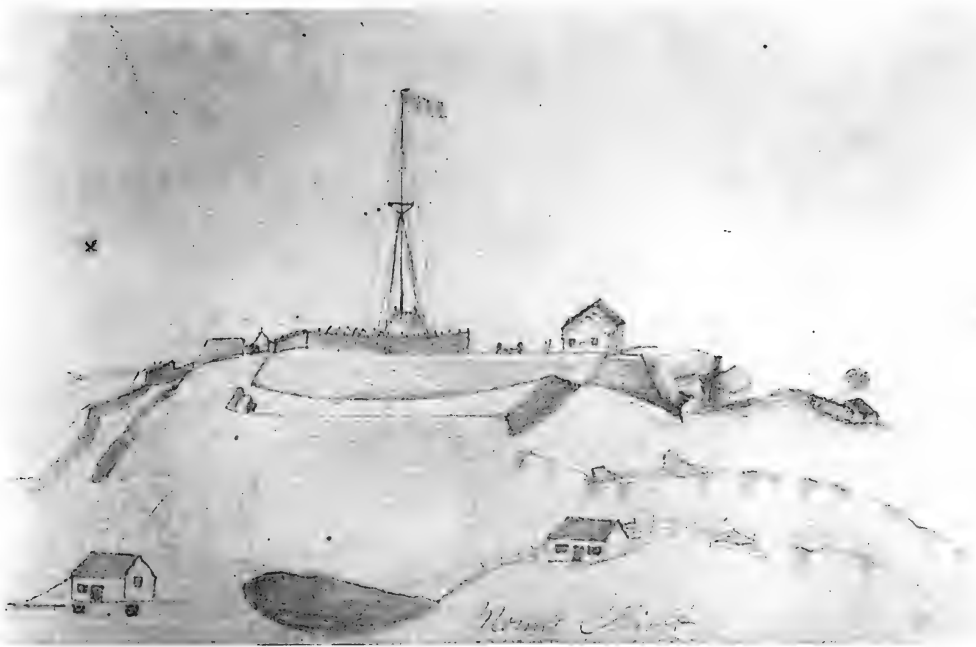


Fig. 2. 'Mount Elliot', from the south, showing earthwork and stockade fortification. At left can be seen the town defences. (Anonymous, pencil, Taranaki Museum.)



Fig. 3. Marsland Hill barracks and stockade, the signal mast can be seen at left, St Mary's church below. 'Dec 17th 1862 New Plymouth'. (H.J. Warre, pencil, Rex Nan Kivell Collection, National Library of Australia.)

gate at the east end of the work. There is a later panorama photograph of the fort in the Taranaki Museum. An early 1870s plan of buildings on Mt Eliot is included among Army Department files held in the National Archives, Wellington (AD1, 71/293).

Mt Eliot stood between lower Brougham Street and the present Queen Street–St Aubyn Street corner. It has since been totally removed to provide fill for nearby reclamations. No archaeological evidence remains.

### *Marsland Hill*

On Marsland Hill were the headquarters for imperial troops and local forces from 1855 until the 1870s and 1880s (Fig. 3). A pre-European pa, Pukaka, which once occupied the hill, is shown with double ditch and bank in an 1844 Edwin Harris watercolour of New Plymouth, held in the Taranaki Museum. The troops removed 40 feet (12 m) from the top of the hill to provide a platform for the military establishment.

A pre-fabricated iron clad barrack building arrived from Melbourne on the *Alexander* in June 1855 (Scholefield 1960 I:167). The barracks were for 35 years a landmark in New Plymouth. A plan is given in a letter of 1874 from Inspector Tuke to the Armed Constabulary Commissioner in Wellington (PI/23 Taranaki). In 1891 part of the building was removed to the slopes of Mt Taranaki where it still serves as a mountain hut at North Egmont.

Figure 4 shows the Marsland Hill military establishment. Barracks, magazine, guard house and well are surrounded by a palisade at the north end of the hill. An entrenched area on the ridge to the south encloses soldiers' huts and parade ground. The latter was known as the 'plateau'. On the flanks of the hill are hospital, married men's quarters, officers' mess, theatre, engineers' quarters and commissariat.

A description of the stockade is given by Sergeant Thomas Oldfield, Armed Constabulary, writing in 1872:

"The Stockade itself, although looking very formidable at a distance; is in reality a very slight affair, which would be of little or no use in the event of an enemy attempting to attack it; the palisading being formed of slabs from 2 1/2 to 3 inches through, nailed at the top and bottom to two rails, which are morticed into posts set in the ground."

(PI/14 Taranaki)

In the Mundy Album, held in the Auckland Museum, photographs show a light stockade barely 2 m high, without loopholes.

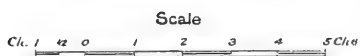
Marsland Hill was the focus of a signalling system throughout the First Taranaki War and for part of the second war. Canvas covered wicker balls were raised or lowered on the yards of a signalling mast. The mast stood within an earth breastwork extending south of the stockade on top of the hill (see Figs 3 and 4). At different times the system reached north to Waitara and south to St George's Redoubt at Tataraimaka. The Taranaki commanding officer Colonel Warre reported this system discontinued on 28 July 1865, by which time telegraph lines served instead (AD31/24).

The last imperial troops in New Plymouth, a detachment of the 18th (Royal Irish)

Plan of  
**MARSLAND HILL**  
(Pukaka)

*New Plymouth*

*Shewing old Barracks &c  
during Military occupation  
from Jan. 1856 to Jan. 17<sup>th</sup> 1870.*



*Note. Details of positions of old Barracks &c  
as defined by Military Engineer Officers survey.*



Fig. 4. 'Plan of Marsland Hill (Pukaka) New Plymouth'. (DOSLI, New Plymouth, 8722.)

Regiment, left Taranaki on 17 January 1870 and an Armed Constabulary guard of one sergeant and 11 men was put in charge of Marsland Hill (AD1 71/293). Most of the military buildings were by this time in a dilapidated state, the stockade itself being repaired later that year. The A.C. continued to use Marsland Hill throughout the 1870s. In 1874 much of the barracks was taken over to house immigrants (P1/23 Taranaki).

Marsland Hill now lies within a New Plymouth District Council reserve. (Map references and New Zealand Archaeological Association site record numbers are listed in Appendix 1). There is no surface evidence of the fortification. Archaeological deposits may be intact on top of the hill, on the 'plateau' to the south and on the hillsides below. Dumped rubbish is reported to have come to light during construction of paths which now encircle the hill. In the 1980s a metal trunk containing armourer's equipment was recovered by Roger Fyfe of the Taranaki Museum from 2.5–3 m depth on the side of the hill off Robe Street.

## THE SETTLER FORTS

Work started on the Bell Block and Omata Stockades before the March 1860 outbreak of war. They were designed and built by rural settlers to protect homes and farms and act as refuges. In the event, Maori forces so controlled the countryside that these intentions were not realised: virtually all homesteads outside New Plymouth were burnt down, stock driven off, and families forced to take refuge in town. For many years the two posts served military objectives, keeping a watch on enemy incursions in the New Plymouth area and acting as way stations for operations north and south.

### *Bell Block Stockade*

The Bell Block Stockade (sometimes 'Bell Blockhouse' or 'Hua Blockhouse') was built early in 1860 (Figs 5 and 6).

"A very general desire was manifested to erect rude but effective fortifications in several districts as rallying points; but the uncertainty that still exists whether the Militia (who are directed to be called out forthwith) will be permitted to resist aggression in their own homes, or be required to serve elsewhere, has delayed if not defeated the excellent proposal. The Bell and Hua settlers are unremitting in collecting the materials for a blockhouse which in addition to completely accomplishing the purpose for which it is designed, will serve as a signal station between the Town of New Plymouth and the Waitara."

*(Taranaki Herald 25 Feb 1860)*

The blockhouse building was designed by local settlers and completed under the direction of W.B. Messenger of the Taranaki Militia, a member of a pioneering Omata family (Cowan 1922–23 I:160). The cost of materials was met by the government (AD100 60/36). The best description of the post is given by the Omata settler and chronicler of the First Taranaki War, William Grayling:

"It occupies a commanding position, and presents an impregnable fort to any enemy devoid of artillery. Its length is 62 feet; width, 22 feet; height, 11 feet. A ditch surrounds the fort, enfiladed by two towers, 22 feet high, at its opposite angles. These towers are 11 feet square, and, similarly to the body of the building, judiciously loopholed, and rendered musket and ball proof..."



Fig. 5. Bell Block Stockade from the north-east, showing the blockhouse with two towers, stockade with tents inside, flag pole and signal mast, and accommodation huts outside. (F.H. Arden, pencil and wash, Taranaki Museum.)

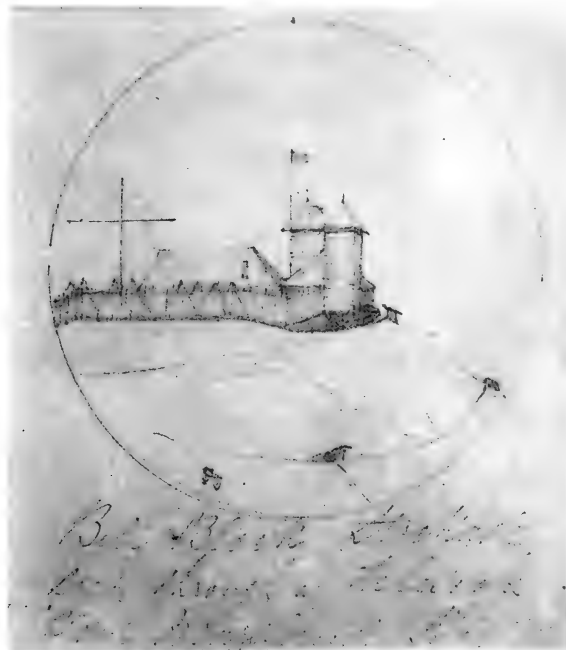


Fig. 6. 'Bell Block Stockade seen through a telescope from Marsland Hill', showing the blockhouse with towers, stockade with tents, and barrack building and signal mast at left. (Anonymous, pencil, Taranaki Museum.)

The first expedition had started for the Waitara, the disputed land occupied by the Queen's troops, and the L pa shelled, before the blockhouse was completed. It was garrisoned by 50 Militia and Volunteers, and, for many months, no addition was made to the force. Eventually, 150 of Her Majesty's troops were sent down, who constructed an entrenched camp immediately adjoining; two 9-pounder field-pieces being placed in position. The force was not materially lessened during the war.

By degrees mess rooms and cook-houses were added, as well as a commodious guard-room, which was built at the Government's expense, and the roof of the blockhouse boarded and shingled; whilst the interior of the building was made comfortable by the addition of a floor, and bunks for the men to sleep in."

(Grayling 1862:87–88)

Grayling's account makes it clear that at first only the blockhouse was built, with the stockade added on the arrival of the troops. In early April Sergeant William Marjouram of the Royal Artillery set up a signal mast at the post (Marjouram 1861:191).

The garrison was at first made up of local forces, commanded by Captain Morrison. The Taranaki Museum holds the manuscript "Journal of Officer in Charge, Bell Block" for the period 11 July–14 December 1860. When General Pratt arrived in Taranaki in August 1860 there were 135 12th Regiment, 46 Taranaki Militia and three Royal Engineers at the post (Carey 1863:46). After the engagement at Māhoetahi and the new post established there numbers were down to 56 65th Regiment, 45 Militia and three Royal Engineers (Carey 1863:141).

During the war of 1860–61 skirmishes took place in the Bell Block district between the stockade garrison and parties of Māori. Both sides burned dwellings, destroyed farm produce and drove off stock belonging to the enemy. For example on 5 April 1860 four or five farmhouses were set alight, watched by their owners from the blockhouse (Marjouram 1861:194). Military movements and skirmishes are recorded by the *Taranaki Herald's* "own correspondent" at the post.

After the ceasefire of March 1861 troops other than the 57th Regiment left Taranaki. In December 1862 there were 23 of the 57th at Bell Block, along with local men (Warre 1878:165). When Waitara was abandoned in May 1863 at the beginning of the Second Taranaki War, Bell Block was the only Pākehā post north of New Plymouth until February 1864, when the European forces again turned their attention north of New Plymouth. Bell Block Stockade was abandoned in winter 1865 (AD6/4 65/4120).

The blockhouse and stockade at Bell Block are depicted in a number of contemporary paintings and sketches. Cowan (1922–23 I:161) provides two illustrations from drawings by Arden dated 1863. These are similar to pencil and wash sketches held in the Taranaki Museum, the more informative of which is given in Figure 5. The anonymous pencil drawing given in Figure 6 shows the blockhouse from the other direction.

The stockade was located where the present tavern stands on the hill top at Bell Block. An aerial photograph taken in August 1950 shows an earthwork apparently with three adjacent entrenched areas (Fig. 7). The site survived until 1970 when it was completely destroyed in a few days as construction began on the hotel buildings. No plan was made and no salvage excavation undertaken.



Fig. 7. Earthwork remains of Bell Block Stockade, August 1950. (New Zealand Aerial Mapping, 1784/5.)

### *Omata Stockade*

The second of two settler forts erected north and south of New Plymouth early in 1860 was built on the site of an old pa, Ngaturi, on the property of Mr Richard Julian at Omata (Fig. 8). The outline of history and archaeology given here is taken from my report on 1977 excavations at the Omata Stockade site, to which readers will have to turn for more detail (Prickett 1994).

The stockade was designed and built by settlers – Thomas Good initially planning the work and supervising construction. Preparation of the hill and ditch, splitting logs and preparing shingles and other work was carried out by settlers on militia pay and rations. A few settlers were paid by the government for carting and building. Captain George Burton was responsible for internal fitting out. In April a signal mast was set up. On 12 June 1860 the stockade was reported finished.

During the war of 1860–61 Militia and Volunteers at Omata varied from 54 to 73. After the defeat at Puketakauere on 27 June 1860 and the pulling back of troops from Tataraimaka, 12 Royal Artillery with two guns were added to the garrison. Captain Burton was the commanding officer throughout the First Taranaki War.

The stockade sometimes came under fire from enemy forces which remained in the





Fig. 8. Omata Stockade from north-east, 1975.

district until the March 1861 ceasefire. Nearby farm houses and other buildings were destroyed. In August 1860 a Maori party burned to the ground the hotel and most of Omata village, a few hundred metres from the stockade (*Taranaki Herald* 11 Aug 1860). On 23 February 1861 troops who arrived with provisions for the post were fired on from the old pa Te Ngahoro, over the gully north-west of the stockade. A skirmish took place in which Pakeha took the position and the Maori force retired to their stronghold on Waireka Hill (*Taranaki Herald* 23 Feb 1861).

A garrison was maintained at Omata between the wars and throughout the Second Taranaki War. One man was still on pay at the post as late as May 1866. Towards the end of its life part of the stockade was used as a school. In late 1867 a report was received that the stockade was being demolished by local farmers for firewood. Orders were then given that the materials be sold by public auction.

A detailed description of the work, with the illustration given here in Figure 9, was published by Colonel J.E. Alexander, who commanded the 2nd Battalion, 14th Regiment, in New Zealand from 1860 to 1862 (Alexander 1863a). Alexander visited Omata after the 1861 ceasefire. His description is published in my report on the site and is not repeated here. Other historical pictures of the stockade may also be found in the excavation report.



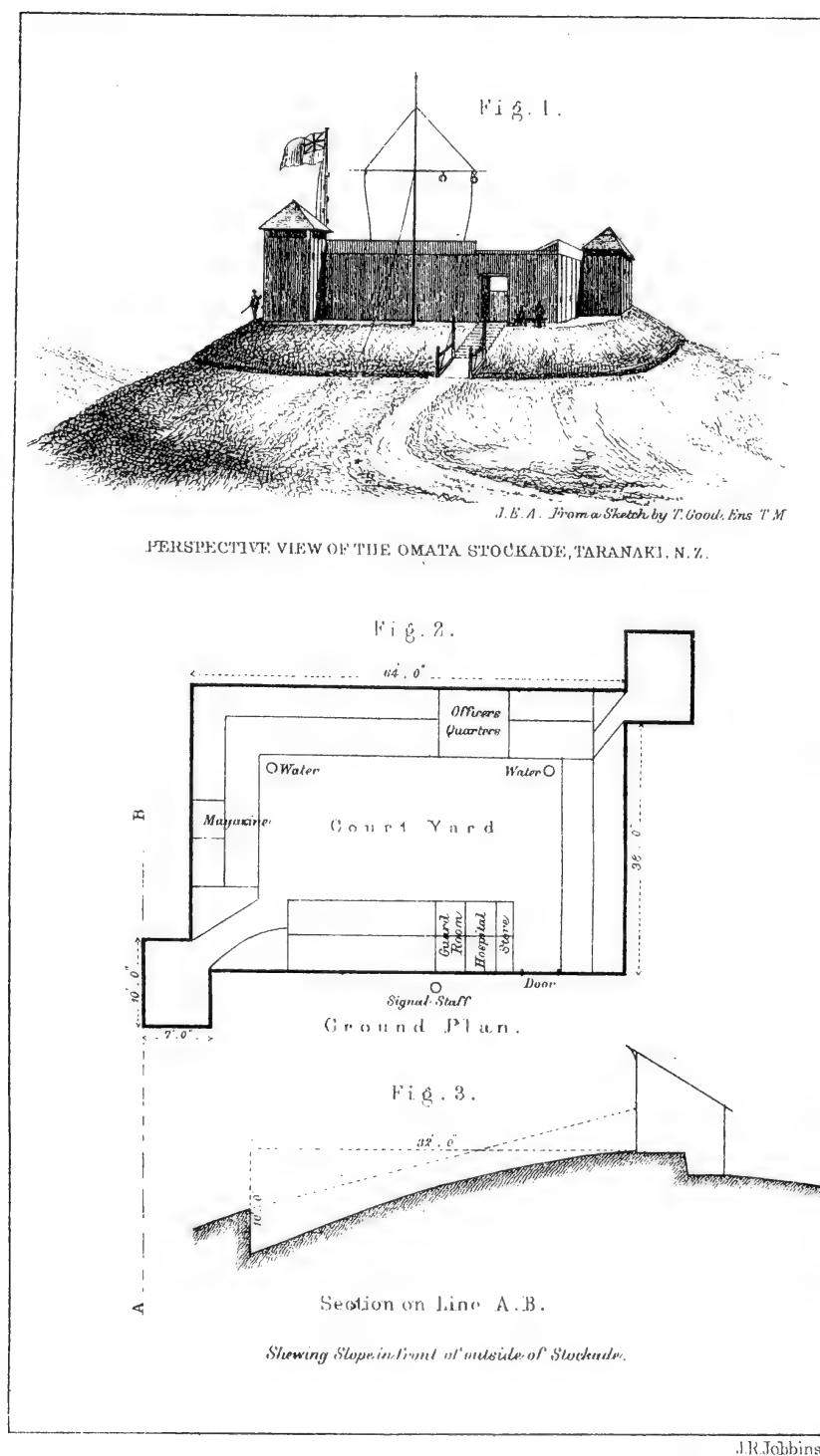


Fig. 9. Perspective sketch, plan and section of the Omata Stockade (Alexander 1863a).

The rectangular timber stockade of 19.3 x 12.8 m had two 3.2 x 2.3 m bastions at the north–west and south–east corners to provide flanking defence for all four sides. Inside, a small open yard was surrounded by accommodation for officers and men, guard room, hospital, store and magazine. The side walls had a single row of loopholes. Bastion towers had two rows of loopholes, and a third level of firing positions beneath the roof. Outside the stockade the hill was cut away to fall steeply into a ditch and more gently beyond, all covered by defenders at the loopholes. The site is now in a Department of Conservation historic reserve, located beside the South Road at the top of the rise out of the Herekawe Stream valley immediately outside New Plymouth.

THE OCCUPATION OF WAITARA

On 1 March 1860 Governor Gore Browne, and Colonel C.E. Gold who was in command of troops in New Zealand, arrived in New Plymouth from Auckland. With them were reinforcements of the 65th bringing New Plymouth troop numbers to 448 in addition to Militia and Volunteer units which were being rapidly mobilised (GBPP 1861:11). On 5 March the greater part of the troops marched out to Waitara to protect the survey of disputed land. There they established an entrenched blockhouse at the mouth of the river and a large redoubt a little inland.

In a despatch to the Duke of Newcastle, Colonial Secretary, dated 12 March 1860 (GBPP 1861:12), Browne briefly describes the military moves which were to have such incalculable consequences for Taranaki and New Zealand.

“My Lord Duke,

In continuation of my Despatch, Separate, of the 2d March, I have now the honor to inform your Grace that Colonel Gold marched to the Waitara with the troops as per margin on the morning of the 5th March, and reached the encamping ground about 11 A.M.

I reached that place in H.M.S. “Niger” about four hours earlier. Some boats from the ship landed at once, and my Private Secretary, Captain Steward, Lieutenant Blake, R.N., and Mr. Rogan, Native Agent, seeing no one, advanced to meet the troops. They soon, however, discovered a number of natives lying in ambush, well concealed.

After some talk with the Native Agent, who told them they were between the troops and the sailors, they retired, saying they would return.”

Browne listed the troops who went to Waitara as follows:

Corps etc.	Officers	Sergeants	Drummers	Rank & File
Staff	5	2	–	–
Royal Artillery	1	2	–	18
Royal Engineers	1	1	–	10
65th Regiment	12	22	9	313
	<hr/>	<hr/>	<hr/>	<hr/>
	19	27	9	341

During the night of the 5th Te Atiawa built a small pa on the disputed land to command the road to the soldiers’ camp. When an attempt was made to stop troops travelling to and from

Waitara Camp Browne despatched a note, “To the Chief who obstructs the Queen’s road”, threatening to attack in 20 minutes if the pa was not abandoned.

“This had the desired effect, and the pah (which was found to have traverses, and to be extraordinarily well designed) was burnt by the troops.”

(GBPP 1861:12)

I have not been able to locate this fortification.

A second pa was built a few days later at the south–west corner of the disputed land. Here were fired the first shots of the war on 17 March 1860. This pa was named Te Kohia by Te Atiawa. To Taranaki settlers it was known as ‘L–Pa’, from its shape.

#### *Maori settlements at Waitara*

Te Atiawa kainga at the mouth of the Waitara River in early 1860 are given in a number of sources. A “Plan of Pekapeka Block” by the surveyor Octavius Carrington, enclosed in a report from Lieutenant H.S. Bates (AJHR 1863 E–2), shows four settlements close together on the south bank of the river. From the seaward these are Te Whanga, Kuikui, Hurirapa and Wherohia. Except for Hurirapa all are marked as having been destroyed in March 1860. Figure 10 shows the location of the four kainga, and of the remaining kainga and blockhouse after the destruction of three of them.

Bates’ report gives details. Kuikui, with approximately 200 inhabitants, and Wherohia, about 35, were occupied by Wiremu Kingi and his people and were destroyed. Waitara

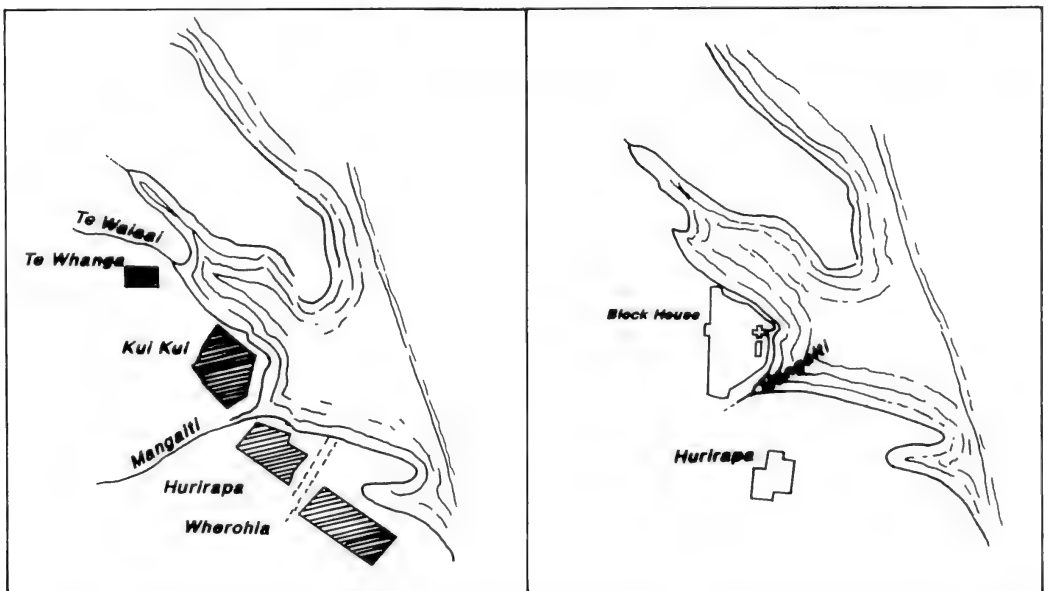


Fig. 10. Left: Te Atiawa kainga at Waitara before the arrival of troops in March 1860. Right: Waitara Blockhouse and Hurirapa pa, late 1860. (Redrawn from Octavius Carrington, ‘Plan of Pekapeka Block’, October 1860, AJHR 1863 E–2; and ‘Plan of Peka Peka Block Waitara West District’, 1939, DOSLI, New Plymouth, 104A).

For cultural reasons, these images have been removed.  
Please contact Auckland Museum for more information.

Fig. 11. 'Pah at the mouth of the Waitara River N.Z. 1861.' Shows Hurirapa from the north.  
(J. Phelps, watercolour, Auckland Institute and Museum.)

Fig. 12. 'Ihaia' a Pah at the mouth of the Waitara – from sketch taken by Lt Rees 40th Reg, 10th  
Sepr 1860'. Showing interior of Hurirapa with traversed trench at right and *Tasmanian Maid* at  
anchor in river. (Ink copy of original, Taranaki Museum.)

Blockhouse was established where Kuikui had been. Also destroyed was Te Whanga, which belonged to Tamati Te Ito and his people. Only Hurirapa remained, with a population of 30 or 40 under the leadership of Teira and Ihaia.

Hurirapa is depicted in a watercolour by J. Phelps (Fig. 11), probably Lieutenant John Shaw Phelps of the 2nd Battalion, 14th Regiment (Hart 1861:252), which arrived in New Zealand in late 1860. An ink copy of a 10 September 1860 sketch by Lieutenant Rees, 40th Regiment, shows the interior of the pa, with a traversed fighting trench at the right (Fig. 12).

In Fieldbook H&W6, Department of Survey and Land Information (DOSLI), New Plymouth, is a measured field plan of Hurirapa. This provides the data for finished drawings (such as the 1939 “Plan of Peka Peka Block Waitara West District”, DOSLI, New Plymouth), from which the plan given in Figure 10 is derived. The survey plan is not easy to reconcile with the various pictorial representations. The Phelps and Lees pictures date from some months after, however, and the pa may by then have been modified.

Two invaluable watercolours in the Taranaki Museum, by Captain J.E.D. McCarthy, 40th Regiment, show Hurirapa and the adjacent Waitara Blockhouse. Figure 15 depicts the blockhouse from the north with the pa at left. On “The Mouth of the Waitara from the Camp” – from the south – is written “Hurirapa Pa Chiefs Ihaia, Te Teira, and Big Jim”.

Hurirapa took up the high ground next to the river immediately south of Mangaiti Stream. The site is now occupied by 2 Norman St and 112 Centennial Avenue, and the adjacent street and riverbank reserve. No visible evidence remains.

### *Camp Waitara*

The troops established a blockhouse at the mouth of the river and a large redoubt a little inland. The redoubt was at first named, “... in honour of His Excellency, who was present at the time, ‘Gore Browne Redoubt,’ the name was, however, changed on the 19th of the same month to ‘Camp Waitara’” (Carey 1863:22–23). Camp Waitara was established on a low hill, the site of long abandoned Pukekohe pa, from which there was good command of the nearby river valley (Fig. 13).

Colonel Gold returned to New Plymouth on 24 March at the urgent request of the Governor who feared an advance by Taranaki and Ngati Ruanui from the south (GBPP 1861:24). The Waitara Camp Garrison Order Book, of which the Taranaki Museum holds a microfilm copy, shows that Lieutenant Colonel Sillery then took command. The Order Book gives Captain Barton, 65th, as commanding officer at Waitara from 6 April, with Major Thomas Nelson taking over on 28 May as detachments of the 40th Regiment began to arrive.

When General Pratt arrived in New Plymouth in early August 1860 there were over 500 men at Waitara, mostly 40th and Naval Brigade (Carey 1863:46). In October when Pratt’s column was operating south of New Plymouth the garrison was down to 250 rank and file (Carey 1863:119). On 22 October the senior Royal Engineer in New Zealand, Colonel Thomas Mould, took command (Mould 1863:99). On 19 November 1860 the Waitara garrison was again close to 500 men, still mostly 40th and Naval Brigade, but also with Royal Engineers, Royal Artillery and Militia (Carey 1863:141).



Fig. 13. 'Camp "Waitara"'. The redoubt from the north showing three entrances (with sentries), bell tents, thatched huts and two large tents (left), within earthwork defences. Guns are mounted at the right angle and two left angles. In the right distance are the remains of Puketakauere pa and the British flag flying over Puketakauere Stockade at Onukukaitara. (J.E.D. McCarthy, watercolour, Alexander Turnbull Library.)

On 10 December the headquarters of the 40th Regiment moved to Waitara under Lieutenant Colonel Leslie (Smythies 1894:376). By the end of the month almost 1400 men were encamped there, including Royal Engineers and Artillery, 12th, 40th and 65th Regiments and Naval Brigade (Carey 1863:145). On the 28th Pratt himself arrived from New Plymouth to take command (Smythies 1894:376). Throughout the long advance on Huirangi and Te Arei in the summer of 1860–61 Camp Waitara was the headquarters of the army in New Zealand. On 23 January 1861 the garrison stood at 390 men, and on 10 February, 585 including casualties (Carey 1863:163, 172). Camp Waitara was abandoned in April 1861.

A few days after the 19 March 1861 ceasefire a correspondent of the *New Zealander* visited the redoubt, his report reprinted in the *Taranaki Herald* of 13 April.

"It is pitched on the Southern bank, on rising ground, at a short distance from the river; the approach being up a gently rising mound, terminating to the Eastward with an abrupt descent, at the foot of which there are a chain of marshes that, at one time, appear to have formed the bed of the river. The position is well watered, strong, and judiciously chosen; it is entrenched on all sides, has latterly been greatly enlarged, and, at the time of my visit, was occupied by detachments of the 12th and 14th Regiments, Naval Brigade, and a portion of the Royal Artillery and Engineers."

The earthwork redoubt was built in two stages. In charge of the first stage was Lieutenant



Order Book 9 April 1860), probably prefabricated in kauri as were many Taranaki block-houses in the early 1860s. Construction was supervised by Lieutenant Mould, R.E. (G16/1a 2462). On 28 July 1860 the *Taranaki Herald* reported,

“The Block-house on the Waitara Point is all but finished, and is guarded by Captain M’Carthy’s company of the 40th, and Lieut. Kelly’s company of the Naval Brigade, with a six-pounder.”

In January 1861 Waitara Blockhouse was held by 50 men and on 10 February by 30 (Carey 1863:163, 172). After the war, until May 1863, the post was held by the 57th Regiment with local forces. When General Cameron inspected the 57th in Taranaki on 22 December 1862 there were 41 non-commissioned officers and men under Captain E. Gorton at Waitara (Warre 1878:165). At the start of the Second Taranaki War the 70th briefly took over garrison duty (War Office 0270.I:34). A decision by Governor Grey saw the land over which the First Taranaki War was fought abandoned on 13 May 1863. Teira and Ihaia were left in charge of the blockhouse with a supply of ammunition (AJHR 1863 E-2).

When Waitara was reoccupied by Pakeha forces in 1865 it was the old blockhouse which was used. For some years the small garrison operated a ferry across the river. It is not known when the post was finally abandoned. In 1869 it was reported that the blockhouse, with accommodation for 60 men, was “in very bad order” (AD35/12).

Waitara Blockhouse consisted of a wooden building surrounded by an irregular earthwork defence. Frederick Carrington’s Fieldbook I18 (DOSLI, New Plymouth) includes a measured plan of the building showing a regular cross shape with arms *ca* 16 ft wide and 26 ft long.

The McCarthy watercolours introduced in relation to Hurirapa show the blockhouse from north (Fig. 15) and south. The cross-shaped building has a corrugated iron roof and is loopholed high under the eaves. An earth parapet is present at the landward sides only. Tent lines can be seen at both sides of the building. The picture not reproduced here shows a cart going to the landing place just up-river from Hurirapa. A pencil sketch by surveyor Thomas Humphries in Fieldbook 3030 (DOSLI, New Plymouth) shows the post later than the McCarthy pictures, with an additional commissariat store building within the earthwork.

In the Camp Waitara Garrison Order Book is a, “Rough Hand Sketch of proposed Block House and defensible Enclosure. Mouth of Waitara”. This locates the cross-shaped blockhouse, gun platforms and other buildings within an irregular bastioned earthwork. Fieldbook H&W6, depicts, probably incorrectly, a T-shaped blockhouse, with out-buildings and a plan of surrounding earthworks, also two cross-sections through the earthworks showing inner drain, banquette, wall and outer defensive ditch. This forms the basis of a published plan enclosed in Lieutenant Bates’ report of April 1863 (AJHR 1863 E-2; and see Fig. 10).

Waitara Blockhouse was situated above a small tidal creek on the south bank of the river, between Te Waiaai and Mangaiti Streams. This was lower ground than that occupied by nearby Hurirapa pa. The blockhouse site is now largely taken up by the houses and sections at 116–126 Centennial Avenue, Waitara.



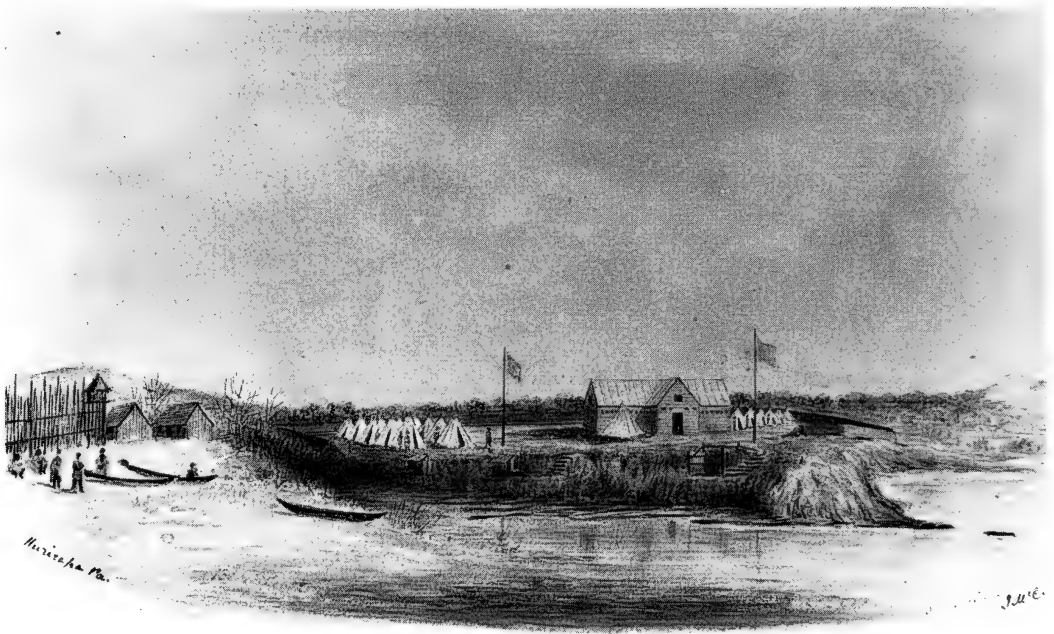


Fig. 15. Waitara Blockhouse from the north. Showing loop-holed blockhouse and tent lines within an earthwork defence. At left is part of Hurirapa pa. (J.E.D. McCarthy, watercolour, Taranaki Museum.)

### *Te Kohia*

On the night of 15 March Te Atiawa erected a second pa, Te Kohia, at the south-west corner of the disputed land. When the occupants refused to surrender, the pa was attacked, this being the first engagement of the war. An account of the 17 March 1860 engagement, along with the plan, perspective sketch and section drawings given in Figure 16, is given in Colonel Gold's despatch (GBPP 1861:16). Rocket tubes and 24-pounder howitzers opened fire from 750 yards, closing to 200 yards. On the morning of the 18th the pa was entered and found to have been abandoned in the night.

Memories of the 1845–46 war in the Bay of Islands quickly returned. Browne wrote to London:

"A pah which they erected in one night, and which was garrisoned only by about seventy (70) Maoris, occupied our troops two days to capture and destroy. A storm of shot and shell did scarcely any execution, and finally it was evacuated with trifling loss..."

Indeed it is not generally known that during the war in the north of New Zealand, the Maoris were always far inferior in numbers to Her Majesty's troops; but their deficiency in this respect was made up for by the strength of the country in which they fought. Their skill in forming traverses and covered earthworks in the pahi is also surprising, and most admirable; in fact, I am inclined to believe that shot and shell are thrown away on these defences and that nothing but an approach by earthwork will be found efficient."

(GBPP 1861:17–19)

For cultural reasons, this image has been removed.  
Please contact Auckland Museum for more information.

Fig. 16. 'Sketch of pah, destroyed on the 18th March, 1860.' Te Kohia, plan, section and sketches.  
(F. Mould, 20 March 1860, GBPP 1861:opp. p. 16.)

Sergeant William Marjouram, R.A., wrote of Te Kohia,

"The stockade was very strong and of great circumference, but the whole of the interior had been cut out into galleries, far below the surface, with roofings of split-timber extending throughout the pa from side to side and from end to end. Above was a thick layer of earth, having a small aperture here and there to admit air. The galleries were lined with fern, while the standing walls of earth were pierced with holes just large enough to admit a man, thus opening a communication throughout. The place had evidently been deserted in a great hurry, for we found potatoes, Indian-corn, dried fish, a war-horn, and several other articles."

(Marjouram 1861:195)

Experience at Te Kohia encouraged the cautious approach to attacking Maori fortifications adopted by Gold and General Pratt throughout the campaign. The study of Maori works by British engineers resulted in plans and section drawings of several pa taken in the war (see Figs 16, 20, 21, 27, 30, and 31). When Captain Mercer of the Royal Artillery returned to Auckland after the Waitara campaign he had pa defences reconstructed on an artillery range to work on the problem of breaching the defences (Lennard 1966:207).

A 1930 survey plan shows the location of Te Kohia in relation to modern roads and land boundaries (DOSLI, New Plymouth No 189). The pa was behind the present Brixton Hall in lower Waitara Road between Devon Road and Raleigh Street. It was situated on flat ground which has been much cultivated since. Some years ago the landowner showed me the site, and cannon balls which he had found there. No surface evidence was located.

### *Northcroft stockade*

In early May 1860 a company of the 40th Regiment, along with Sergeant Marjouram, R.A., and two gunners with a rocket tube, constructed a stockade, “after the Maori fashion”, in a ploughed field beyond Bell Block Stockade (Marjouram 1861:203). Marjouram was under orders to establish a signal station to open communication with Waitara Camp, the flagpole of which was visible from the new post (GBPP 1861:59), but presumably not from the settler stockade at Bell Block. After only a few days a scare at Waitara saw the troops ordered forward to boost the garrison there. The stockade was destroyed on their departure.

The location of this fort is not known, except that it was on European farm land, inland of Devon Road and west of Waitaha Stream. Colonel Gold reported that he ordered the troops to a “...commanding situation (North Croft) at the upper extremity of the Bell block” (GBPP 1861:59). In the *Taranaki Herald* of 25 August 1860 is a report of militia and troops going from Bell Block Stockade to the area of Paraite pa (on Paraite Road) inland of Devon Road, “...to the abandoned camp of the 40th, on Mr Northcroft’s hill”.

### WAIREKA

At the southern boundary of the Omata district the Tapuae Ridge is the highest ground to reach the coast between Parininihi (White Cliffs) and south Taranaki, giving wide views of the country north and south. The ridge was used by Pakeha and Maori for a number of fortifications in the war of 1860–61, and again early in the Second Taranaki War, and was the scene of fighting in both campaigns. On 28 March 1860 a fight took place around a pa called Kaipopo, on a northern spur of Waireka Hill.

### *Kaipopo*

Kaipopo was thrown up on Waireka Hill in March 1860, immediately above the then main road and the old Omata cemetery. In *The War in Taranaki*, Grayling (1862:23) indicates that work began on Kaipopo on the 26th. The Hurford Road settler Thomas Gilbert reports about 70 Maori starting work on the pa on the 27th, one of them taking a spade from him to help with the work (Gilbert 1861:62, 69).

Gilbert later visited Kaipopo and reported 400 Maori in residence.

“I saw how they had burrowed into the earth; first covering their square holes with rails, doors, and boards, and then putting the earth thrown out over them... I observed that the intrenchments were made on the town-side of the pah only... The pah itself was made of rails and posts cut from the fences near, tied with flax and some wire, from a wire fence close at hand, occasionally twisted in. I did not view it as a very formidable affair, but ugly and forbidding enough in its commanding position – especially as a steep hill must be ascended to get at it from the road.”

(Gilbert 1861:104)

The builders of Kaipopo used material from nearby Pakeha homesteads and fences.

Two days after the so-called ‘Battle of Waireka’ the pa was destroyed by men from the Omata Stockade on 30 March. George Jupp who was one of the party commented that they

found two pa, "... very strong with chambers underground where they could fire out without themselves being seen" (Jupp Diary 30 March 1860).

No surface evidence survives of the Maori works at Kaipopo. A former landowner, the late Mr W.S. Hamill, described to the writer dropping a tractor wheel into a pit or cavity, *ca* 20 m from the crest on the north side of the hill. It may have been a rifle pit or artillery shelter relating to the pa, or perhaps a *rua kumara*.

## TATARAIMAKA AND WAREA

On 20 April 1860 nearly 500 men of the 65th Regiment, Naval Brigade, Artillery and Engineers, under Colonel Gold, marched south to the outlying Tataraimaka Block to give settlers who had abandoned their farms an opportunity to harvest their crops. The force also reconnoitred as far as Warea, destroying Maori property and subsistence. When Gold returned to New Plymouth on 29 April 200 men were left to hold two positions at Tataraimaka.

In his report of 30 April 1860 Gold states his reasons for leaving troops on the southern block:

"It is now my intention to establish two permanent posts, of 100 men each, in excellent positions, which are capable of being maintained by settlers when the services of the troops are required elsewhere. By doing so I hope to restore confidence where it is much wanted, and protect much valuable property from being burnt or removed by the enemy."

(GBPP 1861:58–59)

The Tataraimaka garrison was made up of three companies of the 65th with two guns (Alexander 1863b:131–132). A history of the 65th Regiment tells us the detachments were under the command of Captains Turner and Strange (Broughton 1914:46). The posts took the names of their respective commanding officers (New Plymouth Garrison Order Book 3 May 1860). The troops at Tataraimaka were withdrawn on 29 June following the defeat at Puketakauere (Grayling Journal 29 June 1860).

The location of both posts is given on a map, "New Zealand Province of Taranaki, From Waitara to Oeo", by Octavius Carrington, dated 10 June 1862 (copy in the Taranaki Museum). On the map itself they are stated to be "blockhouses", which is most unlikely. The map key calls them "military positions". They were probably redoubts with tents inside.

## Warea

Gold marched south of Tataraimaka on 26 April. Beyond Hangatahua (Stoney River) a Maori settlement and mill were destroyed. Next day the force marched on to the Teikaparua River. Here was Warea, a stockaded pa south of the river mouth, and an old pa inland which was no longer occupied. Gold threw a few artillery rounds into Warea from the terrace edge north of the river – where five years and a day later the 43rd Regiment established Warea Redoubt. (Excavations at Warea Redoubt are reported in Prickett 1994). When troops began to move around the pa it was quickly evacuated and was then burned.

Gold's force spent the night at Warea. Gold himself says the troops camped in the old

pa nearby, also destroyed before leaving the following morning (GBPP 1861:58–59). Richard Brown, a militiaman who took part in the expedition writes, “The tents are pitched on an old Kumara ground, an earthwork thrown up and the cattle yarded inside the guns and carts” (Greenwood 1967:119).

Today at Warea there is surface evidence of pits which have been ploughed a number of times and of which little more can be said. The inland pa was probably all or part of Tarakihi, a very large fortification with substantially intact earthworks 3–400 m inland on the right bank of the river (see Prickett 1983). Tarakihi is known to have been occupied in the mid–19th century.

Warea was subject to an unusual episode earlier in 1860. Two days after the 28 March engagement at Waireka Captain Cracroft was ordered south of New Plymouth in HMS *Niger*. In his report (GBPP 1861:29) he describes arriving off the pa – “...or pahs, for there appeared to be two, surrounded by stockades”, anchoring about 2500 yards off with a heavy surf running, and opening fire with guns and 24 pounder rockets. People appeared in great numbers at one of the pa and fired at the ship with muskets in defiance. Cracroft claimed that shells and one rocket exploded within the stockades. A photograph copy of a painting showing the *Niger* bombarding the distant stockade is held in the Auckland Museum (Fig. 17).

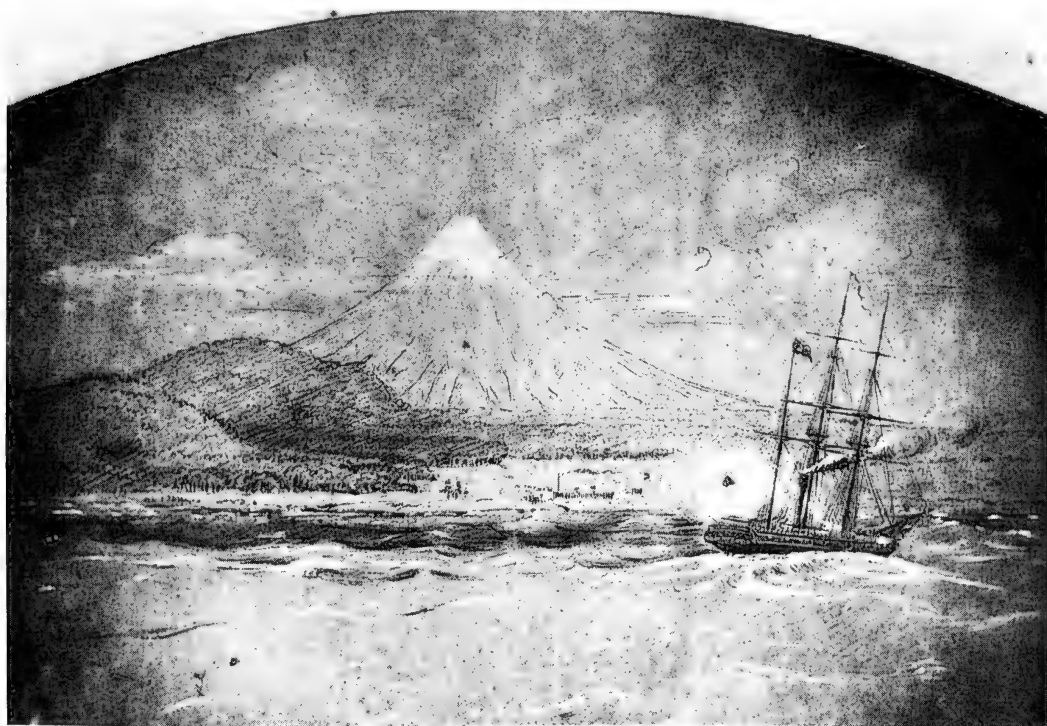


Fig. 17. HMS *Niger* bombarding Warea, 30 March 1860. (Crombie photograph of unknown original drawing, Auckland Institute and Museum.)

*Mahainui*

After the April expedition the Warea missionary Riemenschneider wrote to Gold with information on other pa in the district (Carey 1863:51–60). Of three Taranaki iwi fortifications he was able to visit only one, Mahainui, on the summit of a small hill four or five miles inland in forest country. There was the usual double stockade, rifle trench and underground artillery proof bunkers. Riemenschneider writes of the Taranaki tactic of quickly reinforcing any pa under attack by way of inland routes through the dense forest.

Mahainui was located *ca* 800 m seaward of the important pre-European Taranaki pa, Tapuinikau. I am informed by Warea historian Kelvin Day that Mahainui was largely destroyed by giant discing in the mid-1970s and that all that remains is a small section of terrace along the east side.

*Fort Strange*

In the *Taranaki Herald's* 13 October 1860 account of General Pratt's Kaihihi River expedition, it is stated that the force camped at, "...Bayly's farm, or what was formerly known as Fort Strange." Thomas Bayly owned 364 acres on both sides of Lower Pitone Road between Katikara River and Pitone Stream (Crown Grant Record Map/Wairau and Cape, DOSLI, New Plymouth). This enables us to name the two posts shown on Carrington's 1862 map.

Carrington's map shows the post to be close to Lower Pitone Road, *ca* 200 m from the beach, on the north side of the road. The location has been searched without result. It is likely, however, that the map is wrong and the post was at a more commanding situation on the south side of the road, near or at the site of St George's Redoubt, established early in the Second Taranaki War.

*Fort Turner*

Since Fort Strange is on Pitone Road, the site shown on Lower Timaru Road on Carrington's map must be Fort Turner. Archaeological evidence which fits the map location can be seen east of the road halfway between the Greenwood Road corner and the sea. A trench with unmistakeable signs of having been angled for gun defence encircles a prominent natural mound, dipping low on the northern side where terraces indicate living quarters (Fig. 18). Part of the hill has since been removed to provide a platform for a farmhouse, of which only the chimney now stands.

*Tataraimaka pa*

The enemy having abandoned Tataraimaka, Maori forces moved on to Pakeha farm land in the district where several pa were thrown up. Little is known of these. Taranaki settler William Grayling (1862:36) says there were, "...no less than ten strongholds on the settlers' grounds at Tataraimaka", but is probably exaggerating. The pa apparently included the two abandoned Pakeha forts, taken over by Maori forces (Grayling Journal 29 June 1860). At the end of August, Native Secretary Donald McLean reported 200 Taranaki and Ngati Ruanui holding several pa at Tataraimaka (GBPP 1861:126).



Fig. 18. Fort Turner, showing the entrenched hill from south, 1975. Chimney of later farm house at left.

In September Major Hutchins led a reconnaissance force to Tataraimaka and beyond. On Mr Greenwood's farm immediately over the Timaru River were found five pa with double stockades, strongly entrenched, extending in a line from the coast ("*en echelon*"), inland to the site of the erstwhile Fort Turner. These were presumably placed to contest the Pakeha return to Tataraimaka, or at least inflict a defeat on the returning enemy. They were, however, empty and were destroyed, as also were three kainga and a set of rifle pits (see Pratt's report GBPP 1861:148, and *Taranaki Herald* 29 September 1860). The location of the pa is not known, except at Fort Turner, the remains of which may owe something to Pakeha and Maori work.

## PUKETAKAUERE

In June 1860 Puketakauere and Onukukaitara were thrown up by Te Atiawa and allied tribes on the sites of older fortified pa, on high ground outside the disputed land at Waitara. The earlier pa are shown on Frederick Carrington's 1841–46 map "Plan of Manu–Kori Pah... and Part of the Surrounding Settlement" (copy in Taranaki Museum). Major Nelson who was in command at Waitara reported construction beginning on 8 June with 40 or 50 men engaged (AJHR 1860 E–3C). On 19 June Nelson reported 200 Maori on the site. On the 24th a message





Fig. 19. Puketakauere (right) and Onukukaitara (Puketakauere Stockade) from south-west, 1975.

arrived from Hapurona, the Te Atiawa fighting chief, to say that he was not yet quite ready. The messenger, Methodist missionary John Whiteley, suggested Maori preparations would take two or three days more (AJHR 1860 E-3C).

An attack on the pa on 27 June 1860 by more than 300 of the 40th Regiment, Naval Brigade, Royal Artillery and Engineers was beaten off with heavy losses. It was the major Maori success – and defeat for European forces – in the First Taranaki War. Two months later the Maori garrisons abandoned both pa. They were destroyed by troops on 29 August (Carey 1863:85–86).

Puketakauere and Onukukaitara occupy low mounds *ca* 200 m apart on a spur which runs towards the Waitara River between Devon and Pennington Roads, and between the steep-sided gullies of Tutererua and Mataiaua streams (Fig. 19). Plans and sections of both pa by Lieutenant Frederick Warburton, R.E., were enclosed in Pratt's 8 September 1860 report in *Selections from Despatches and Letters Relative to the Conduct of Military Operations in New Zealand 1860–5* (War Office 0270.II:23–24; Figs 20 and 21). The two positions can be seen in a watercolour by Colonel Warre dated 4 March 1861, held in the Taranaki Museum.

#### *Puketakauere*

Figure 20 shows Puketakauere to include a stockaded platform 30 x 21–18 m surrounded by double ditch and bank. A correspondent of the *Taranaki Herald* (8 September 1860) reported one of the ditches to be nearly 20 ft (6 m) deep. The defended area was *ca* 585 m<sup>2</sup>.



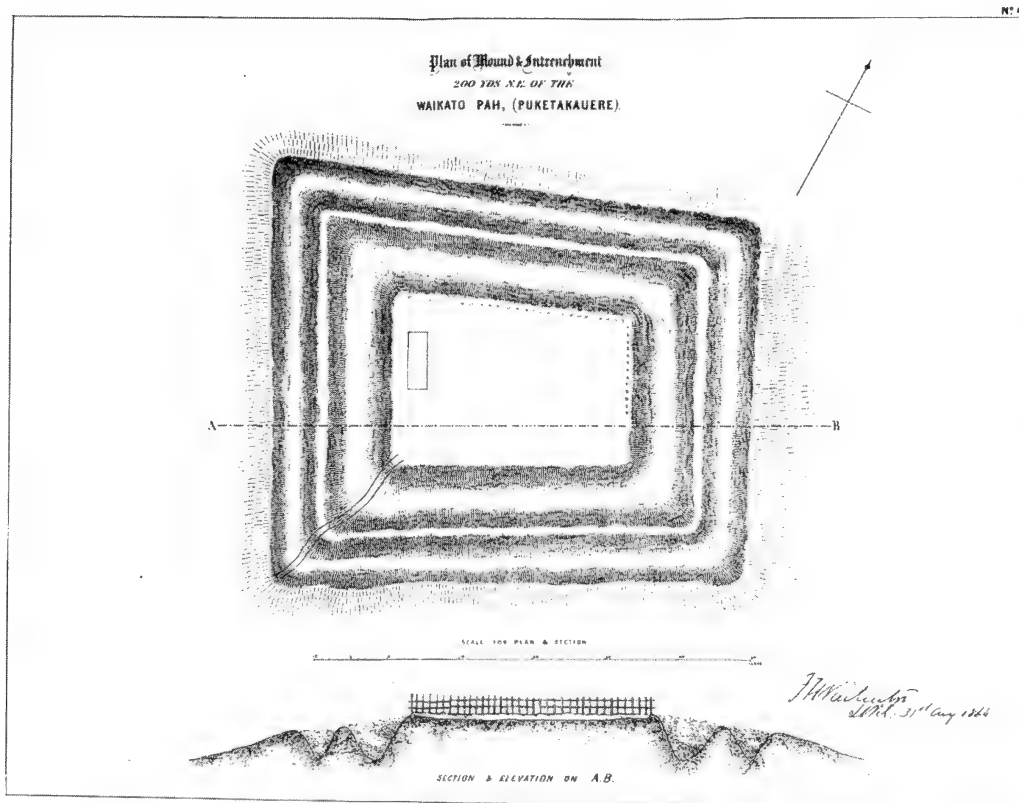


Fig. 20. 'Plan of Mound & Intrenchment 200 yds N.E. of the Waikato Pah, (Puketakauere).' Onukukaitara was thought to be garrisoned largely by Waikato. (Lieutenant Warburton, 31 August 1860, War Office 0270.II:25.)

The Maori work was occupied briefly by troops engaged in constructing the stockade on Onukukaitara. On the afternoon of 25 September the defences were thrown down and the site never re-used. The site appears not to have been greatly damaged since. In 1983 it was purchased by the Crown and is now a Department of Conservation historic reserve.

### *Onukukaitara*

Lieutenant Warburton's plan and section (Fig. 21) of Onukukaitara are supported by a written account by fellow Royal Engineer, Captain Charles Pasley. This deserves space here as a valuable general description of pa of the 1860–61 campaign.

"At the period of its abandonment by the enemy, Onukukaitara (commonly but incorrectly called Puketakauere) contained a quadrangular earthen redoubt about 22 yards by 18, with a command of 14 feet obtained by scarping the sides of the highest portion of the hill. This redoubt formed a sort of citadel to the pa. At the foot of the escarp, and surrounding the redoubt on three sides, was a trench for musketry (usually termed rifle-pits), about 4 feet in depth, and varying in width from 3 feet to 20, with traverses. Outside of the trench was a line

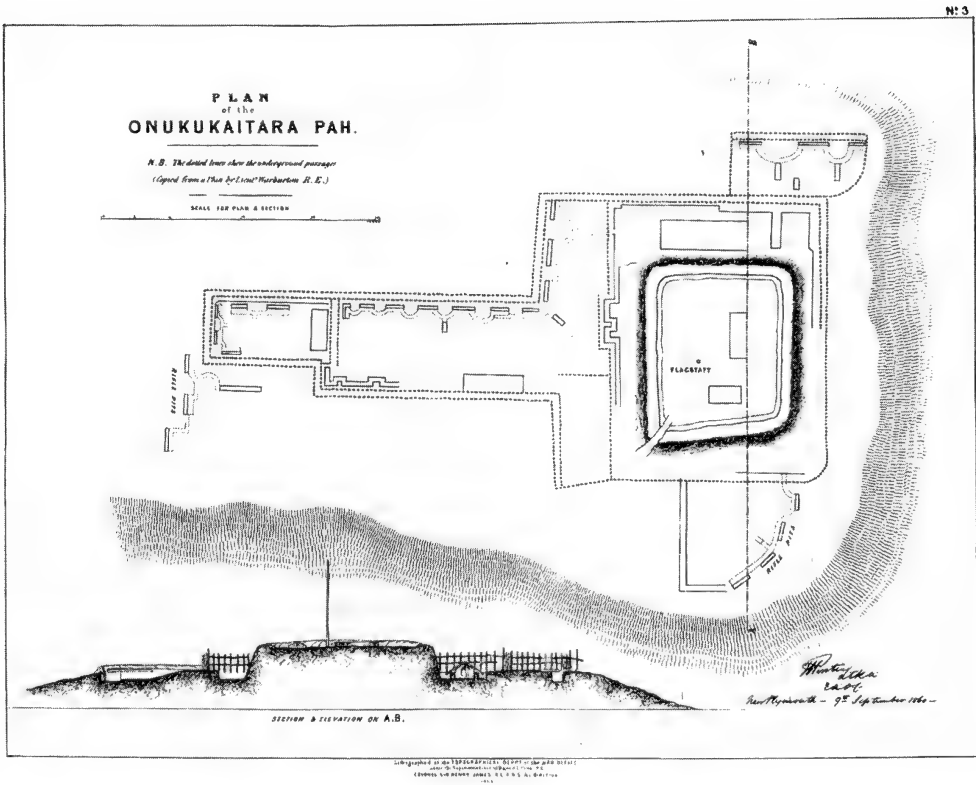


Fig. 21. 'Plan of the Onukukaitara Pah.' (From an original by Warburton, War Office 0270.II:23.)

of palisades partly double and partly single, but always sufficiently open to allow musketry fire from the trench to pass through it. At the northern angle was a palisaded outwork 26 yards by 10, containing a series of covered splinter-proof rifle-pits, connected by semicircular underground passages. A similar underground passage under the palisade of the main work connected the rifle-pits of the pa with the outwork.

At the south-east angle was an unfinished outwork, consisting of a breastwork and rifle-pits without palisading. From the south-western side of the redoubt an outwork, broken into flanks, and divided into several portions by interior palisading, extended for about 60 yards along the crest of the hill, surrounded by a double palisade with covered rifle-pits, some of which were incomplete. Beyond this again, towards the south, were a series of covered rifle-pits without palisading.

The design of the work was well adapted to the site, the strongest and best flanked defences being on the south-western side, where the hill rises from the plain by a gentle ascent. On the north-west and south-east sides the pa was protected by deep gullies, and on the north-east it was covered by Puketakauere pa, which was also in the occupation of the enemy, and which, notwithstanding its defective palisading, was capable of offering a serious resistance to an assault, and was so well covered by swampy and almost impassable gullies, that it would have been scarcely possible to attack it at all until Onukukaitara should have fallen. Both the pas contained several native huts, or "wharres," which were generally covered from distant fire.

On the 27th June, 1860, when the pa was attacked, 46 shells were fired from two 24-pounder howitzers at a range of about 400 yards without effecting a breach in the palisading. The rifle-pits were constructed in a very simple manner. A series of pits 4 feet wide, 4 feet deep, and 8 or 10 feet in length, were dug 3 feet back from the line of palisades. These were covered for about three-fourths of their width with split timber, over which was laid a covering of earth and fern 3 or 4 feet in thickness, leaving openings for musketry 1 foot or 15 inches wide along the whole length of the pits. Posted in these pits, the enemy were perfectly protected from horizontal fire, and in a great measure even from vertical fire, unless heavy mortars were brought against them. The difficulty experienced in effecting a practicable breach in a pa is chiefly due to the mode of fastening adopted for the palisading. The inner line is a regular stockade consisting of unhewn timbers, of dimensions varying according to the nature of the neighbouring forest, sunk several feet into the ground, and further strengthened by two or three horizontal ribands, to which every timber is firmly tied with a peculiar tough fibrous grass. Intervals of a few inches are left between the timbers, to serve as loopholes for musketry. The outer line is not so solid as the inner. It consists of strong posts firmly planted in the ground at intervals of 8 or 10 feet, and connected by two ribands, which carry a row of palisades raised about 2 feet from the ground, in order to enable the fire from the rifle-pits to pass under them. The whole is so firmly bound together by the tough grass before alluded to, that shot and shell pass freely through both lines, often cutting completely through the timbers without causing any portion to fall.

When an attack is expected it is the custom of the Maories to cover the outer palisades with bundles of the long leaves of the New Zealand flax, which offers some resistance to musketry, and serves in a great measure to conceal any damage that may be done to the palisades or stockade by artillery."

(Pasley 1863:568–588)

Warburton's plan has north to the top. The main part of the defended area is a square *ca* 37 x 37 m, some of which is elevated. Rifle pits joined by underground passages are behind the usual double stockade line. At one side of the high ground is a second, incomplete, traversed line of rifle pits. Two small extensions, one defended only by a trench and rifle pits, total *ca* 300 m<sup>2</sup>. A larger projection of *ca* 45 x 7–11 m (425 m<sup>2</sup>) extends from the west side, towards the easiest approach for an attacking force. The total defended area is *ca* 2100 m<sup>2</sup>. The archaeology of Onukukaitara is given under 'Puketakauere Stockade'.

### *Puketakauere Stockade*

In October a Pakeha stockade was built at Onukukaitara. This was to provide a view over the fern covered plain south and east, and house a signal station for communication between Waitara and New Plymouth. The fort was named 'Puketakauere Stockade' although located on Onukukaitara, after the name given to the engagement of 27 June. Colonel Mould's account of work on this post has much of general interest on the construction of stockades by the British army in New Zealand.

"23 October.— On the morning of the 23rd October, marched with a party of 110 men from the [Waitara] camp with a quantity of rough timbers in carts, which had been previously prepared, to the ridge on which the abandoned paha of Onuku-Kaitera and Puke-Takanere [sic] had been situated, and set out a stockade on the centre of the site of the former pah to accommodate 50 men, employing 60 men as a working party, with the remainder thrown out to cover the operation; one-half of the circuit of the stockade was completed during the day. The rough split timbers of the stockade averaged about 8 inches in diameter, were 14 feet

long, and were let into the ground about 4 feet, touching each other. The whole of the men bivouacked on the ground during the night, one-half being on the site of each pah, protected by the old banks thereof, raised where necessary to give more cover.

24th October. – Proceeded with the stockade as rapidly as the very unfavourable weather and the supply of timber, which had to be brought from the low grounds over bad roads, would admit. Parties of equal number as yesterday were employed, who bivouacked on the ground during the night.

25th October. – Proceeded with the stockade which was closed in at noon. A flag-staff was erected, and an ensign hoisted at 5 p.m.; 50 men were left within the stockade as a guard. In the afternoon the whole of the banks of the Puke-Takanere pah were levelled, and the ditches filled in.

26th October. – Commenced the erection of the requisite cover for the men and stores within the stockade, filling in the interstices between the main timbers of the stockade, and also digging a ditch round. One-third of the guard were employed on the unskilled labor; artificers of the Royal Engineers and Militia on the other works. The guard was relieved at sunset.

27th October. – ...The Onuku-Kaitera stockade, with its buildings and the surrounding ditch, were continued day by day; the detail of one-third of the guard and artificers, as mentioned yesterday, being employed until its completion.”

(Mould 1863:99–100)

Work on the stockade and internal buildings took four weeks. At first Lieutenant Warburton was in charge, responsibility later being taken over by Lieutenant Battiscombe, who finished work at the post on 21 November (Battiscombe Journal).

Puketakauere Stockade was occupied throughout the advance on Huirangi and Te Arei in early 1861, relaying signals to and from the battlefield which could not be seen from Waitara. There were garrisons of 30 and 19 men in early 1861 (Carey 1863:163, 172). After the March 1861 ceasefire an officer and 50 men were in residence (*Taranaki Herald* 13 April 1861). The position was abandoned soon after. The stockade was destroyed by Hapurona in July 1863, following the Pakeha departure from Waitara at the beginning of the Second Taranaki War (*Taranaki Herald* 18 July 1863). A sketch by the surveyor Thomas Humphries shows the stockade and signal mast from Camp Waitara (Fig. 22).

Today the site consists of a trench as much as 10 m across surrounding the remains of the ca 13 x 19 m British stockade platform, presumably formed from the high point in the pa which it replaced. Most of the platform has been removed by bulldozer, and damage has also been done to the trench on the southern side. A large water tank sat on the platform when last seen by the writer in June 1993. Since the mid-1970s shelter belts for horticultural development conceal Onukukaitara from almost any vantage point. A 1970s photograph (Fig. 23) shows the dominating situation of the pa and subsequent British stockade and signal station.

## THE DEFENCE OF NEW PLYMOUTH

Throughout the winter of 1860 Maori forces effectively controlled the north Taranaki countryside except for outlying Pakeha posts at Omata, Bell Block and Waitara. After their success at Puketakauere large parties came close to New Plymouth, plundering and burning outlying houses, killing stragglers and apparently threatening the town. In early July Colonel



Fig. 22. 'Puketakauere from the Camp'. Showing Puketakauere Stockade with signal yard and flag on the site of Onukukaitara pa. Left are the ruins of Puketakauere pa. (Thomas Humphries, Fieldbook 3030, DOSLI, New Plymouth.)



Fig. 23. Onukukaitara (Puketakauere Stockade) from the south, 1975.

Gold, Major Herbert, commanding the Militia and Volunteers, and Captain Mairis, Royal Engineers, decided to enclose the town within a fortified line (*Taranaki Herald* 7 July 1860). The work was rapidly pushed ahead under Colonel Mould's supervision following the arrival of General Pratt in early August (War Office 0270.II:140).

The *Taranaki Herald* "Journal of Events" for 6 August reported:

"There is a general impression that an attack on the town may be attempted by the natives, and every precaution is made to meet it. The Light Company of the 65th were brought this evening from the Henui, and camped in Liardet-street, near the Wesleyan Chapel. The headquarters of the 40th were moved from Fort Murray and camped on the Market-Place, Devon-street. 40 men were left in the Fort. The different companies of Militia and Volunteers had their stations marked out, and all families living outside the lines were ordered to remove into town. The trenches are being vigorously proceeded with, and palisading put up in various parts of the town; gates are erected across the streets. The outlying piquet is brought in from the race-course and stationed in the trenches."

### *The entrenchments*

A "Plan of New Plymouth shewing the lines of Defence and outer line of Blockhouses" (War Office 0270.II:opp. 23) locates the New Plymouth defences. The trenches extended from Mt Eliot, along Queen and Robe Streets to Marsland Hill, from there to the Liardet-Courtenay Street corner, then down Liardet Street to the beach (Fig. 24). A southerly extension from Marsland Hill enclosed the soldier's huts and parade ground on the 'plateau'. Two 32-pounder guns were mounted behind a breastwork at the south end of the ridge.

Use was made of a short stretch of the Huatoki Stream gully for defence, but apart from that what is now the centre of New Plymouth was entirely enclosed by a trench and earth breastwork or palisade. There were six gates through the defences: Mill Gate in Queen Street, South Devon Gate on Devon Street at the Queen Street corner, Theatre Gate on Robe Street at the Fulford Street corner, Carrington Gate on Powderham Street immediately outside the present Taranaki Newspaper building, Wasley Gate on Liardet Street at the Courtenay Street corner, and North Devon Gate at the Liardet Street-Devon Street corner.

Outside the trenches was a ring of blockhouses, and various buildings and positions held by pickets. In the war of 1860-61 the latter included a ball-proof picket house located on the present Robe Street reserve, Brown's house at the site of the Apostolic church on Courtenay St, Ward's house at the corner of South and Belt roads, Hamerton's house at about 175 Gill St, and the Coleman and Shute houses on Rogan St. Most of these positions are marked on a 1938 "Map Showing Positions of Guard and Block Houses and Sentry Posts thrown out around Town of New Plymouth Maori War 1860-61" (copy in Taranaki Museum). Sentries were posted in other locations near blockhouses and pickets.

Rural settlers who were not manning the posts at Omata and Bell Block moved into town. New Plymouth was in a constant state of excitement as alarm and rumour swept the town. When an attack seemed imminent women and children would gather behind the defences on Marsland Hill and troops and militia manned the trenches. The *Taranaki Herald* reported on 4 August 1860:

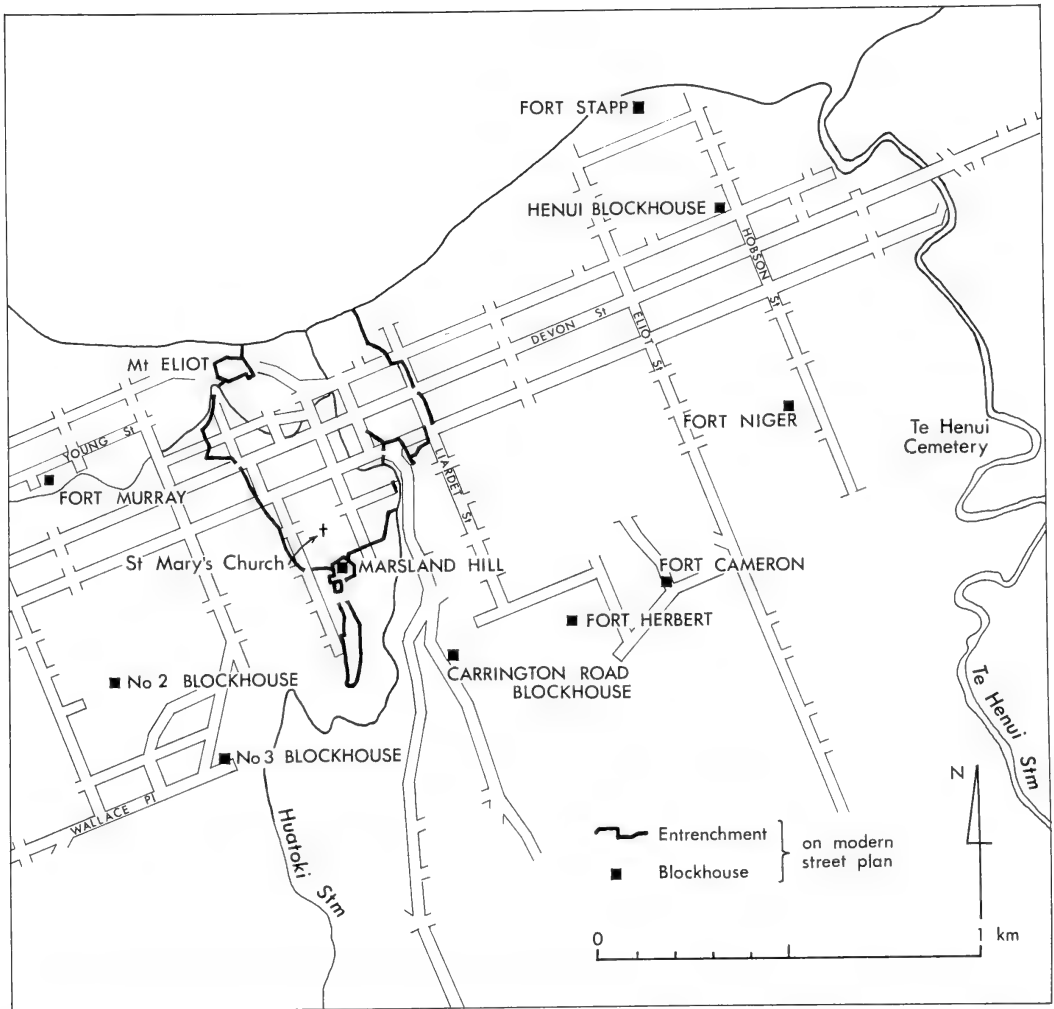


Fig. 24. New Plymouth entrenchments and blockhouses in the First Taranaki War, on a modern street map.

“At 10 o’clock this morning the alarm guns from Marsland Hill and Mount Eliot were fired, and the bugles called together the troops and militia, a messenger having arrived in town reporting that the natives were in force in rear of the Colonial Hospital in the Town belt, and that a combined movement was to be made on the town. Intelligence also in town that the troops were engaged on the Bell Block. The troops and militia under arms in readiness to move to any point. The women and children flocked to the barracks from all points.”

### *The blockhouses*

The location of blockhouses around New Plymouth can be seen in Figure 24. All were established in 1860 when the town was hard-pressed by Maori forces. Most continued in use

through the peace of 1861–63, to be held again by strong guards in the early part of the second war. When it was clear that fighting would not return to New Plymouth they were abandoned, only a few remaining in use as barracks for troops and militia stationed in town.

New Plymouth Garrison Orders for 11 July 1863, early in the Second Taranaki War, gives details on blockhouse garrisons and pickets about the town.

"Detail	O	S	C	Dr	P	Corps
Main Guard	0	1	1	1	18	70th
Commissariat	0	0	1	0	9	57th
Prisoners piqt	0	0	1	0	3	57th
Prisoners piqt	0	0	1	0	3	70th
Marsland piqt	0	0	1	0	6	70th
Fort Niger pt	0	0	1	0	3	70th
Fort Cameron	0	0	1	0	3	70th
Carrington Rd	0	0	1	0	3	70th
2 Blockhouse	0	0	1	0	3	57th
3 Blockhouse	0	0	1	0	3	57th
Fort Murray	0	1	0	0	9	57th
Prisks house	0	1	2	0	15	
Boathouse pt	0	0	1	0	12	
Browns house	0	1	1	0	12	Militia
Northcrofts house	0	1	1	0	12	
Henui Block[hous]e	0	1	1	0	12	"

(New Plymouth Garrison Order Book 1862–64)

A “Return shewing the number of Blockhouses in the Province of Taranaki”, dated 2 June 1866 (AD1 67/4307), lists surviving New Plymouth blockhouses at that date as Fort Murray, No. 2, Carrington Road, Cameron, Niger and Henui. In a similar list for 1869 (AD35/12) are Carrington Road (“Recently repaired. Provincial Govt property, at present used for Militia purposes”), No. 2 (“In a dilapidated state; belongs to Provincial Govt”), and Fort Murray (“In good order”).

*Fort Stapp*

Fort Stapp was named after Captain Charles Stapp, adjutant to the militia and volunteer forces in the early 1860s, and later commanding officer of various corps in the Taranaki military district into the 1880s. Fort Stapp was situated on top of the low sea cliff in the present Mount Bryan Domain, off Octavius Place, and thus commanded the beach north and south. From manuscript garrison order books it can be established that the post was no longer used in the Second Taranaki War, defence in this section of the perimeter being now concentrated at the Henui Blockhouse. No surface evidence remains.

*Henui Blockhouse*

Henui Blockhouse was situated on high ground at the corner of Gill and Hobson Streets, and so overlooked the lower Henui Stream valley. The ground on which it stood was largely intact in the 1970s but is now completely cut away, to be occupied when last seen in July 1994 by “Corys Trade & Electrical Suppliers”.



### *Fort Niger*

Fort Niger was situated on the present Fort Niger Reserve between Pendarves Street and Hobson Street. The hill was formerly the site of the Maori pa, Wharepapa. Fort Niger was established by the Naval Brigade off HMS *Niger* early in 1860, and was held by them for much of the war of 1860–61. It took up a key position at the corner of the area defended by six blockhouses north of the town. On occasions the Fort Niger garrison was given some excitement by Maori forces operating nearby.

“Between 3 and 4 this morning [18 August 1860], a blue light was hoisted at Fort Niger and the alarm bugles were sounded. The sentry at Fort Niger was fired upon by several natives at the distance of a few feet but who missed him. The guard, under Lieutenant Bent, R.M., turned out and gave them a volley when they made a precipitate retreat.”

(*Taranaki Herald* 18 August 1860)

Fort Niger occupied the top of a hill with steep approaches all around except to the south where there is a slight saddle to higher ground. A pencil drawing in the Warre sketchbook, Hocken Library, shows the fort to have included a T or X-shaped building within an earth parapet. On the 75 x 35 m hill-top platform there are today no surface indications of blockhouse or earthworks. Fragmentary glass and earthenware is eroding from steep hillsides below the platform.

### *Fort Cameron*

Fort Cameron, Fort Herbert and Carrington Road Blockhouse were situated at the edge of high ground behind the town. They thus overlooked the secure area within the line of blockhouses, as well as commanding the terrace country to the south now occupied by the racecourse.

Fort Cameron was named some time after its establishment in honour of Lieutenant General Duncan Cameron, commanding officer in New Zealand from 31 March 1861. It was situated on the present Ridge Lane close to the Rogan Street corner. No surface archaeological evidence has been found.

### *Fort Herbert*

Fort Herbert was named after Major Charles Herbert, commanding officer of the Taranaki Militia and Volunteers until February 1862. The blockhouse was no sooner completed than it was burned to the ground, at 3 a.m., 14 July 1860, reported to the Brigade Major by Herbert himself later that day (Taranaki Militia and Volunteers Letter Book). It was quickly rebuilt. When the militia garrison was withdrawn to man the town trenches in early August the post was occupied by allied Maori for the remainder of the 1860–61 war (Taranaki Militia and Volunteers Letter Book: 25 April 1861).

Fort Herbert was situated on high ground immediately east of the present Pukekura Park playing ground, where four or five shallow pits under trees 5 m from Claffey Walk may provide unique archaeological evidence of a New Plymouth blockhouse site. Rubbish in the vicinity appears to be of a later date.

### *Carrington Road Blockhouse*

Carrington Road Blockhouse – sometimes ‘Fort Carrington’ – was situated next to what was then Carrington Road (now Victoria Road). Frederick Carrington was the pioneer surveyor who fixed the site of the New Plymouth settlement in 1840. A sketch by E.A. Williams in the Hocken Library, Dunedin, shows an L-shaped loop-holed building on a broad platform surrounded by a low earth parapet (Fig. 25). An 1869 “Return of Blockhouses, Redoubts and Stockades in the North Island” (AD35/12) describes it as a “blockhouse and redoubt” with accommodation for 50 men.

Today there is a scatter of broken earthenware and bottle glass beneath regenerating bush within Pukekura Park at the top of the Victoria Road hill. The rubbish does not necessarily belong to the blockhouse period. There is no sign of earthworks.

### *No 3 Blockhouse*

The three remaining New Plymouth blockhouses were south of the town. Numbers 2 and 3 were on the edge of the scarp, from which they dominated the low ground to the north as well as the Huatoki Stream valley and the high terrace now taken up by the suburb of Westown. Fort Murray was between Mangaotuku Stream and the sea.

No 3 Blockhouse was situated on the edge of the high ground overlooking the Huatoki

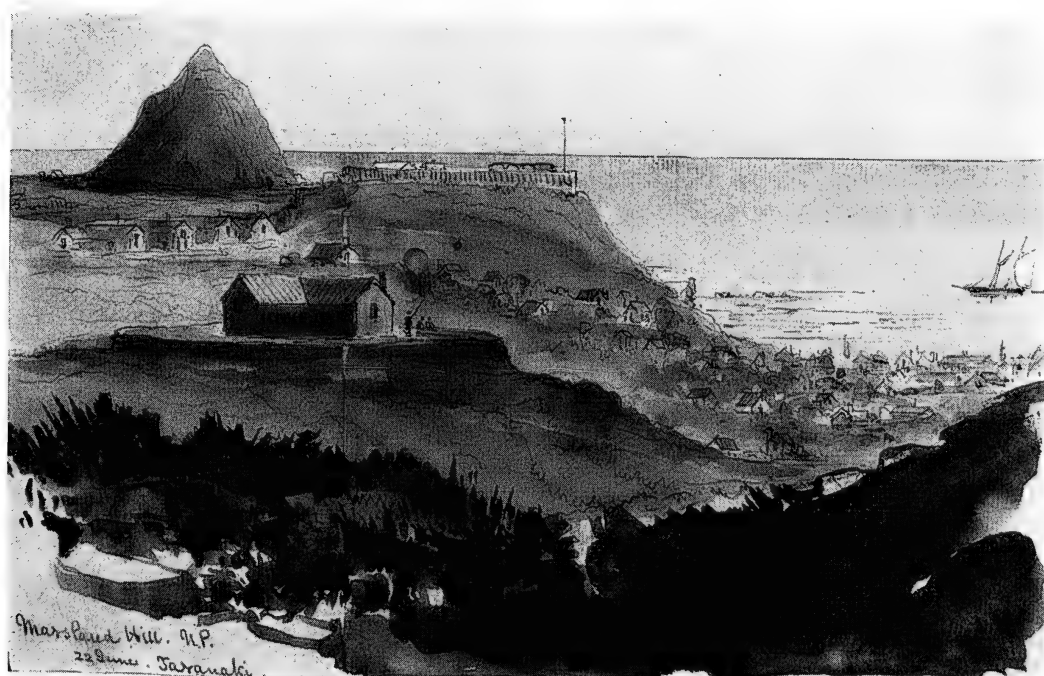


Fig. 25. ‘Marshall Hill. N.P. 22 June [1864]. Taranaki.’ The loop-holed Carrington Road Blockhouse sits on a platform behind a low earth wall. Beyond is Marshall Hill with stockade and iron barracks at right and huts on the ‘plateau’ to the left. (E.A. Williams sketchbook, Hocken Library.)

Stream valley and the Marsland Hill 'plateau'. The site is now occupied by Wallace Place and houses. During garden landscaping some years ago Mr and Mrs Kibby of 3 Wallace Place recovered military items including .577 Enfield bullets, clay pipe pieces (including a 'TD' bowl), buttons of the 40th (two), 57th (four), and 65th (one) Regiments, bottle glass including an intact French wine bottle and part of a case gin, a copper barrel tap ('W.RIGG/PATENT') and earthenware pieces including willow pattern. There are no surface remains.

### *No 2 Blockhouse*

No 2 Blockhouse was located on the terrace edge in front of (or beneath) the present Barrett Street hospital building. The 1869 "Return of Blockhouses, Redoubts and Stockades in the North Island" states that it had accommodation for 20 men. No surface evidence remains.

### *Fort Murray*

Fort Murray was named after Lieutenant Colonel George F. Murray, 65th, who was in command at New Plymouth from 1856 until the arrival of Colonel Gold in March 1860. It was built on the site of a former pa, Rungapiko, at 1–3 Duke Place (formerly the Mt Edgecumbe Street extension) off Young Street, overlooking the Mangaotuku Stream. A photograph in the Taranaki Museum which dates from late last century shows a defensive ditch encircling a small platform. Fort Murray is now completely demolished.

Fort Murray was a large blockhouse with accommodation for 50 men (AD35/12). Like others around the town it was occupied for many years by a variety of regular and local forces. In late 1866 it was occupied by the Military Train because of its stables (AD31/24). In October 1867 the buildings were sold for 42 pounds to the landowner, Mr Knight (AD6/12 67/614/1).

## RETURN TO WAIREKA

When news of the troops' defeat at Puketakauere reached Major General Pratt in Melbourne on 12 July it was at once decided to strongly reinforce the troops in Taranaki. Pratt himself arrived to take command on 3 August (Carey 1863:34–35).

In the meantime New Plymouth was faced with a threat from the south. The *Taranaki Herald* "Journal of Events" of 28 July 1860 reports as follows:

"Friday [27 July]. – a large force of artillery, 12th and 40th, in command of Major Hutchins, started early this morning to take up a position at Omata, to check the onward movement of the rebels. They were seen last night at Wairau, on the beach this side of Tataraimaka, and are believed to be above 1000 strong – including women and children, who have accompanied this expedition to attack New Plymouth...

4 p.m. – The troops are encamped on Jury's hill, on the site of the rebel stockade taken by Captain Cracroft, R.N., and his men, on the 28th March."

### *Waireka Camp*

The force under Major W.J. Hutchins, 12th Regiment, in one day threw up a large redoubt on the hill, all tents being pitched within the defences on the night of the 27th (Grace 1899:42).

The work became known as Waireka Camp – or the ‘soldiers’ camp’ to distinguish it from the settlers’ position at Omata. The Maori force dug in on the high ground to the south now traversed by the main road. Skirmishing took place daily. From the 11th to the 23rd August every wood or water party from the redoubt exchanged shots with the enemy (Webb 1914:279). Grace (1899:41–49) gives a soldier’s eye view of life at Waireka Camp.

Carey (1863:48) gives troop numbers at Waireka at the time of General Pratt’s arrival in Taranaki as follows:

	Field Officers	Cap- tains	Sub- alterns	Ser- geants	Drummers	Rank & File
Royal Artillery	–	–	–	1	–	11
Royal Engineers	–	–	–	1	–	5
12th Regiment	1	1	2	4	1	127
40th Regiment	–	1	2	4	1	103
	<hr/> 1	<hr/> 2	<hr/> 4	<hr/> 10	<hr/> 2	<hr/> 246

Not all military opinion was convinced of the value of the position. Lieutenant Battiscombe, a naval officer stationed at Waitara, wrote in his journal on 26 August:

Tataramaka [sic] has been withdrawn, not being tenable. 200 men have been sent to “Waireka” about 5 miles from the Town, what for common sense can’t tell. They are completely isolated, no earthly use, and 300 men have to march out to them every sunday with provisions ammunition &c.”

Pratt shared this view (Carey 1863:85). When the Taranaki and their allies withdrew southward at the end of August their fortifications were destroyed. Pratt reported Waireka Camp abandoned and thrown down on 7 September (GBPP 1861:144; Grace 1899:53). Waireka Camp was re-used briefly for a day picket and signal mast early in the Second Taranaki War (Prickett 1981:66, 68).

Although Waireka Camp was occupied for only six weeks a very large redoubt with strong flanking defence was built. The earthworks are still distinct despite ploughing, at the corner of Waireka and Sutton Roads just over the fence from the Historic Places Trust plaque to the “Battle of Waireka” (Fig. 26). The redoubt is more than 50 m square, with flanking defence, itself almost 15 m square, at two opposite corners covering all four sides. It is the best surviving example of this classic form of military redoubt in north Taranaki.

The redoubt interior rises to a high point at the east bastion, falling away to the north and west. The bottom of the ditch is now 2 m below the east bastion, 1.2 m below the west bastion and 0.5–1 m elsewhere. A ditch as much as 8 m wide surrounds the work. Access was probably through the eastern or southern sides as these were rear faces. Access now visible across the ditch on the western side will be a recent farming modification since this was the front face and covered from nearby Maori positions. The site has been cultivated. A previous landowner, the late Mr W. Hamill, told the writer that the ditch was maintained by judicious use of a plough.



Fig. 26. Waireka Camp from the north, 1975.

### *Maori works at Waireka*

Major Hutchins in his report gives an account of the Maori works at Waireka which were thrown up on the high ground south of the present corner of Waireka Road and the main road.

“About eight hundred yards directly to our front the rebels burnt a dwelling-house, but left the stable standing on the edge of a gully, purposely to attract the fire of our guns, that they might occupy a number of chambers excavated in the precipitous crest of this gully.

The position of this was sufficient security from the explosion of shells, but to make them bomb-proof they were first covered with timber and then with thick layers of turf. This stable, with the chambers alluded to, surrounded with rifle-pits and two stockades, flanked by a deep and thickly-wooded gully, formed the left of their position. From this, at right angles to a gorse hedge about six hundred yards, ran a red line of earth that looked like a continuous breastwork. It was, however, a chain of rifle-pits, most of which were covered in, with room enough for a man's head and arms to work through. Those left open were in communication with the underground huts, made bomb proof in the manner I have related.

A third stockade, of larger area than those on the left of the rebels' position, was in rear of the centre, and each of these, in addition to a ditch and pallisade [sic], had the interior excavated. To our left, for about nine hundred yards, works of a similar character, with the exception of stockades, were thrown up.

Each of these stockades might have accommodated from eighty to a hundred men, but as the

gullies in rear of every part of their position sheltered a great number of sheds, the information from the friendly pah, with the extent of ground covered, made it exceedingly probable that the entire number of the rebels in permanent occupation was about five hundred.”

(War Office 0270.II:28–29)

Colonel Alexander (1863b:189–190) has this to add,

“The works abandoned by the enemy at the Waireka Hill, six in number, were of the most ingenious construction, both as regards shelter from the weather and safety in retreat; near some of the pits were wharres or huts, where those not required in the pits could take their ease. It was the custom elsewhere for a few to occupy the works at night and make a noise by calling out, or with cow horns endeavour to deceive our people, but doubtless all were ready for a rush to the pits on an alarm.

Some of the larger pits were proof against shells, by a roof of trees, turf and earth, were hollowed out and provided with fire place and a chimney.”

The fortifications at Waireka made up an unusually large work with three strongpoints and lines of rifle pits across a broad front, backed by a deep bushed gully. Major Hutchins was wise not to attack. The position was reoccupied in the summer of 1860–61, and only abandoned when the ceasefire was agreed in March 1861. I have not searched the area; there is a good chance rifle pits will have survived along the scarp above the gully south of the main road.

#### *Burton's farm*

The Native Secretary, Donald McLean, reported on 29 August that Taranaki and Ngati Ruanui were at Burton's farm and Puketotara behind New Plymouth (GBPP 1861:126). Two days later he reported that there were 400 at Burton's farm where, “...it is not their intention to erect a pah, but to make rifle pits” (GBPP 1861:126–127).

From 206 m high Burton's Hill on Barrett's Road is a commanding view to the north, east and west. George Rutt Burton owned a small farm on the hill and was militia officer in command at the Omata Stockade. On the night of 4 September General Pratt took out 700 men to surprise the enemy on the hill, only to find no one there when they arrived. The best account is in the *Taranaki Herald*, 8 September 1860. Sergeant Marjouram (1861:250) who was with the expedition says there were only “temporary huts” on the hill. Colonel Carey (1863:88) says, “The foundations of a pah had been dug, and building materials had been collected”. On their way home the troops burnt Manahi's settlement at Ratapihipihi.

#### *Puketotara*

On 1 September 1860 troops and militia went out from New Plymouth to destroy Puketotara, occupied the night before by ‘friendly natives’. Before that southern Maori or Waikato – or both – were in residence (GBPP 1861:126–127). Puketotara was high on the left bank of the Waiwakaiho River, 5 km behind the town. Colonel Leslie, who was in command of the expedition, reported the pa capable of holding 100 men (War Office 0270.II:28). He describes “...two lines of palisades, the inner one of great thickness.” Behind the pa was a steep slope to the river. The troops pulled down the palisades, filled the entrenchments and burned the timber.

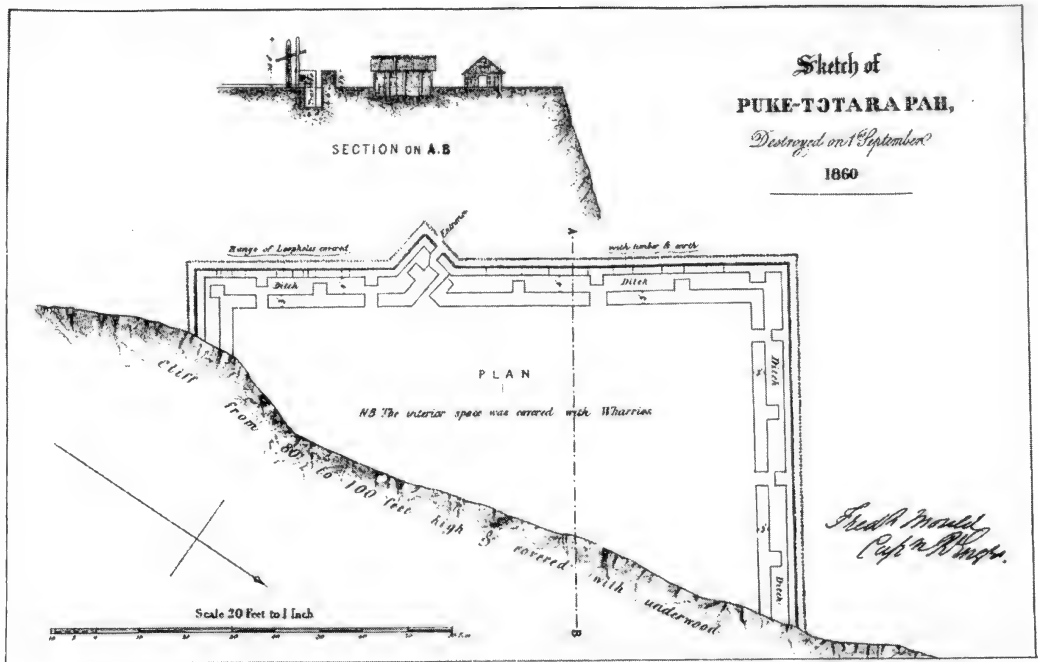


Fig. 27. Puketotara, plan and section. (F. Mould, War Office, 0270.II:29.)

With the troops was Captain Mould of the Royal Engineers who drew the plan and section given in Figure 27. The pa is shown to have been 52 m across the front and 6–32 m deep, *ca* 1000 m<sup>2</sup> in defended area. There is the usual traversed firing trench behind a double line of 10 ft (3 m) palisades. The trench was 4 ft (1.2 m) wide and 4 ft 6 inches deep (1.35 m). Behind was a 3 ft 6 inch (1.05 m) bank, while in front was a 2 ft 6 inch (0.75 m) earth bank against the inner palisade, holed in places for firing through.

Puketotara was east of Mangorei Road near the Karina Road corner, on top of the steep scarp to the Waiwhakaiho River. The exact location is uncertain. It may have been directly opposite the Karina Road corner where Puketotara Blockhouse stood in the Second Taranaki War. The place is now occupied by a two-storey house. A more likely location is the slight mound on the terrace edge, 100 m east of the road behind the house at 357 Mangorei Road.

## WAITARA AND BELL BLOCK

In early September troops returned to the Waitara and Bell Block districts (see Fig. 28). On 2 September a force under Major Nelson destroyed and burned the Te Atiawa pa Tima, Te Puke and Kaipakopako, all south of Devon Road and west of the Mangaoraka River (*Taranaki Herald* 8 September 1860). Ninia had already been destroyed on 21 August by militia from Bell Block Stockade (*Taranaki Herald* 25 August 1860). Tima is described as having a double palisade with trench behind; Ninia had stockades and trenches. Kaipakopako is said to have been an undefended kainga (Cowan 1922–23 II:511).

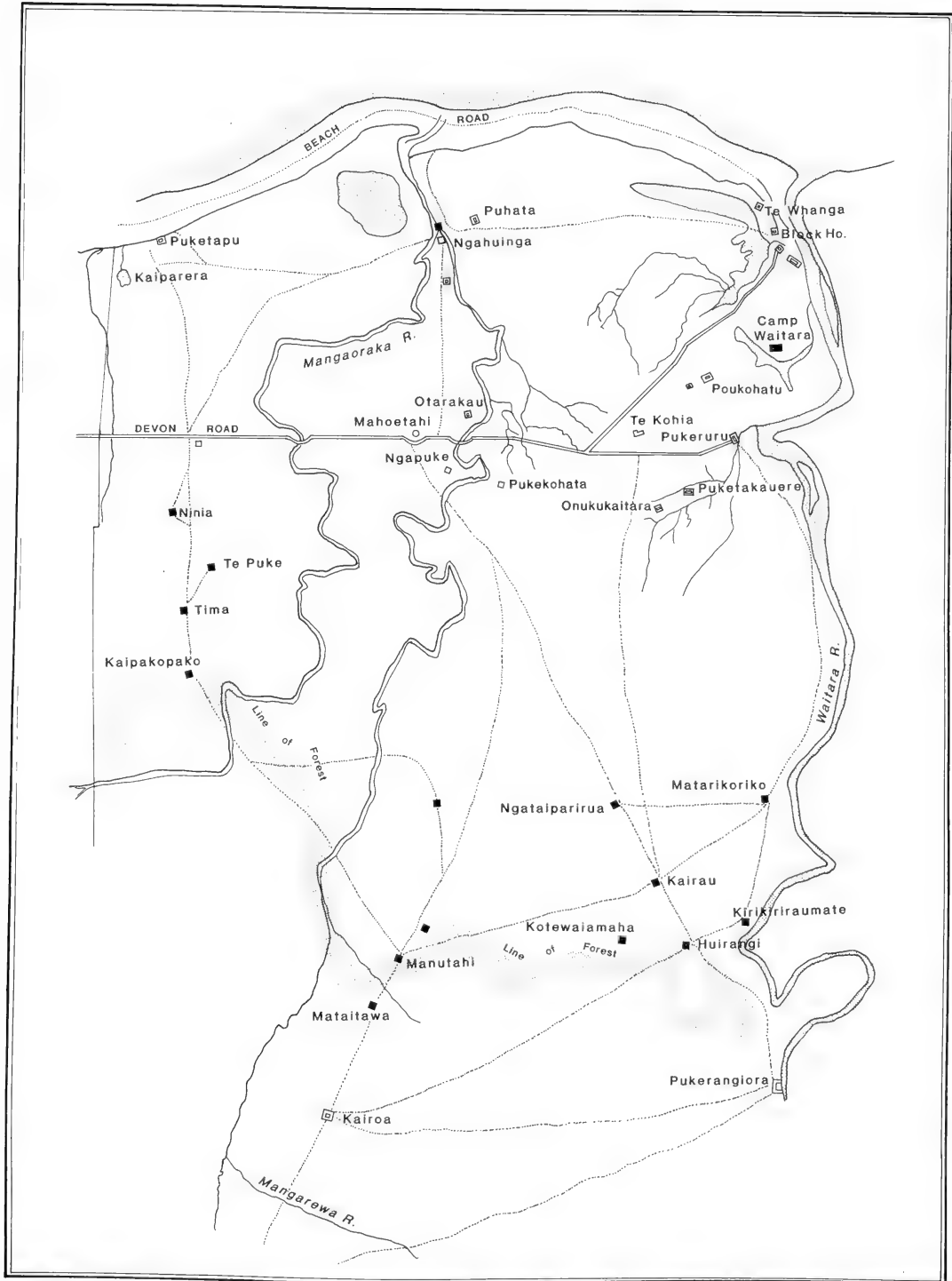


Fig. 28. Waitara, Huirangi and part of Bell Block districts. Solid squares probably show fortified pa of spring 1860. Also marked are other Maori settlements and old pa, the forest edge and cart roads and tracks. (Redrawn from GBPP 1861:opp. p. 144.)



On 3 September Nelson crossed the Waitara River to destroy Korihi and Tikorangi. The latter Nelson described as "...one of the rebels' greatest strongholds". Korihi is situated north of Faull Road between Ngatimaru Road and the Waitara River, not to be confused with Manukorihi on the high north bank of the Waitara River mouth. Tikorangi was not where the road junction and settlement now stands but further up Ngatimaru Road, below the hill.

On 11 September General Pratt took 1400 men to attack pa south of Waitara River. This was the area where, four months later, was the advance to Huirangi and Te Arei and the closing phase of the war. The first pa encountered was Ngataiparirua, west of the present line of Waitara Road. Pratt reported that although there were deep ditches the pa was not as strong as he had been led to believe (GBPP 1861:144). A few shells were thrown in but the pa was found to be deserted. It was destroyed and burnt.

The troops went on to Kairau which was about 900 yards from Ngataiparirua. It too was empty and was destroyed and burnt.

"This pah was understood to be occupied by Hapurona, W. King's fighting chief; it was very strong, and surrounded inside by rifle pits, and covered passages of the most ingenious construction."

(GBPP 1861:144)

Huirangi, at the bush edge 1200 yards beyond Kairau, was entered by Ihaia's people from Waitara who were operating with the troops. It also was found to be deserted and was burnt. Major Nelson then led troops to a small pa to the left (possibly Kerikeriraumati), but was fired on from the nearby bush and so withdrew. Another pa to the right was entered and burnt. This was probably Kotewaiamaha on the bush edge south of Huirangi.

### *Manutahi*

The best description of a Te Atiawa pa in this district is of Manutahi. A few days after the March 1861 ceasefire a party of settlers from Bell Block visited the displaced people of Ninia, Paraita and Kaipakopako, who were living at Mataitawa, on the present Elsham Road above Lepperton. Among the settlers was George Robinson from whom historian James Cowan (1922–23 II:511) years later obtained a description and plan sketch. Robinson states that Manutahi was located about the site of the Lepperton railway station, but in this his memory appears faulty for there is little doubt that the pa was on the other side of the Waiongana River where Lepperton is today, as shown in Figure 28.

Manutahi was sited as a fighting pa – at the forest edge with only one avenue of approach for troops who were known to be reluctant to enter the bush. The strongly fortified front was 100–120 ft (30–36 m) in length. The double stockade and traversed rifle trench behind were as has been described for other pa. Less usual was an 8 ft (2.5 m) deep trench between the inner and outer stockades.

### KAIHIHI RIVER

On 19 September 1860 a force of 12th and 65th Regiments, Militia, Artillery and Engineers, amounting to over 500 men, all under the command of Major Hutchins, marched out of New Plymouth to reconnoitre southward (GBPP 1861:164–166; Grayling 1862:42).

They camped the first night at the mouth of the Oakura River, where St Andrew's Redoubt was established early in the Second Taranaki War. Next day they moved on and camped south of Katikara River on 'Johnny's Flat', after destroying pa and kainga put up on the Tataraimaka Block since the end of June. Hutchins was under orders to avoid engagement with the enemy and returned to New Plymouth on 24 September.

Hutchins' report resulted in despatch of a stronger force early in October to attack positions held by Taranaki and their allies on the Kaihihi River (GBPP 1861:164–166; *Taranaki Herald* 20 October 1860). Pratt himself was in command of 1000 men. On the 9th the troops camped at Fort Strange. The following morning moving on to the terrace near the earthworks of the old Parawaha pa – still a notable archaeological monument on the coast north of Kaihihi Stream (Prickett 1983:16–20).

On 11 October Pratt ordered a sap, or attacking trench, dug towards Orongomaihangī, a pa situated within a bend on the right bank of Kaihihi River, and the strongest and central of three Maori positions (Fig. 29). This was a precursor of the much longer saps at Huirangi and Te Arei in early 1861. On the morning of the 12th the pa were found to have been abandoned

Pl. II

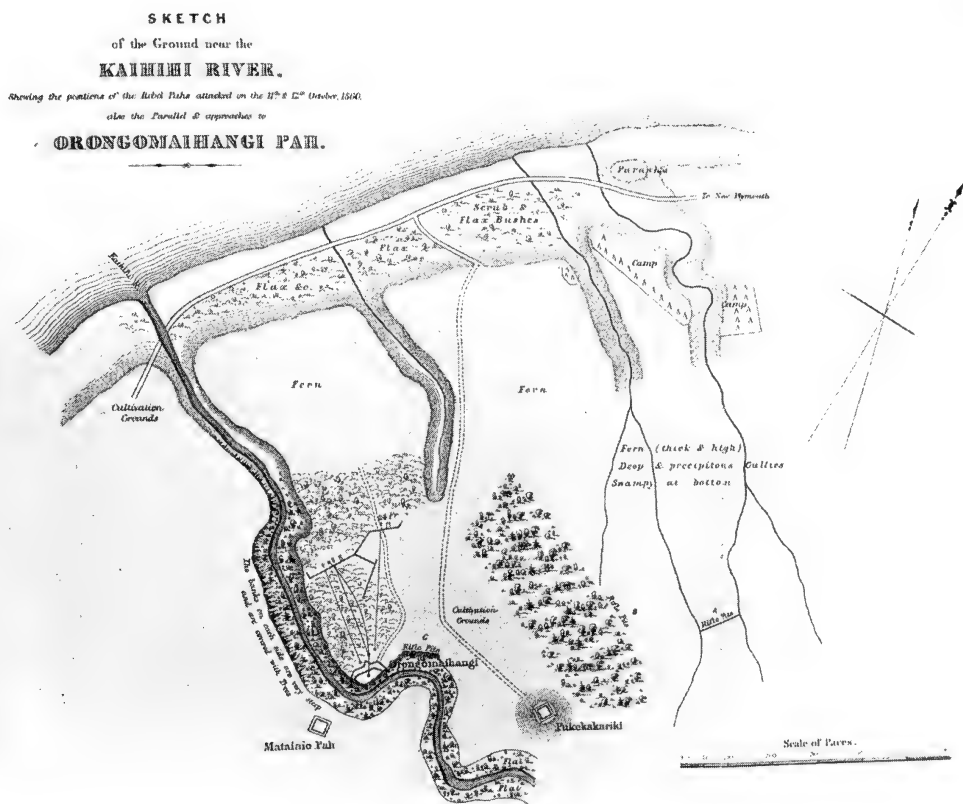


Fig. 29. Attack on the Kaihihi River pa, 11–12 October 1860, showing Camp Parawaha entrenchments, sap, and Orongomaihangī, Pukekakariki and Mataiaio pa and rifle pits (Mould 1863).

and were destroyed. The force returned to New Plymouth the next day. The Kaihihi River expedition proved the last military foray south of New Plymouth in the 1860–61 war.

### *Orongomaihangai*

Figure 30 gives a plan and section of Orongomaihangai. Colonel Mould (1863:98) describes the pa as consisting of,

“...the ordinary two rows of palisades covered with bundles of green flax, then the rifle pits well traversed, backed immediately by the high earthen bank of a pa so old that trees were growing on the summit thereof.”

The drawing gives the palisade height as 9 ft (2.7 m), and depth of rifle pits 6 ft (1.8 m). The bank behind is 6 ft high. The plan shows the fortification to be *ca* 55 m across and a maximum of 47 m deep from the bastion angle. The defended area is *ca* 1200 m<sup>2</sup>. Rifle pits are 6 and 9 ft across.

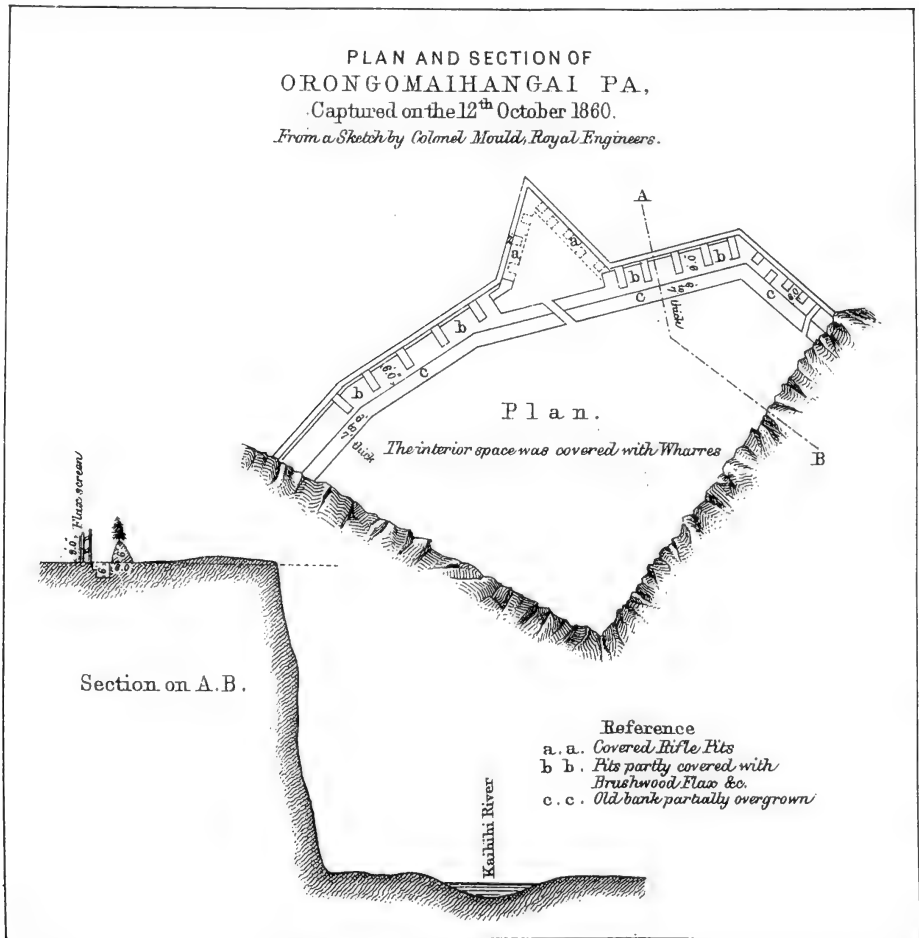


Fig. 30. 'Plan and section of Orongomaihangai pa, Captured on the 12th October 1860. From a Sketch by Colonel Mould, Royal Engineers.' (Pasley 1863).

Orongomaihangī occupies a high point commanding a terrace which falls away at the front, dipping out of sight *ca* 200 m from the pa. It was from the obscured ground that Pratt commenced his sap. At the rear of the pa is a steep descent to the Kaihihi River. Part of this is cliff, but part is an easily negotiable slope down which the garrison made its escape on the night of 11 October 1860.

Field evidence shows the pa to be *ca* 52 m across, and 40 m deep where the remains of the pointed bastion depicted in Mould’s plan can still be seen on ploughed ground. In June 1993 a fence divided the site between cultivated ground and the rear part now overgrown with long grass, gorse, blackberry, kawakawa, cabbage trees and the stumps of several pine trees.

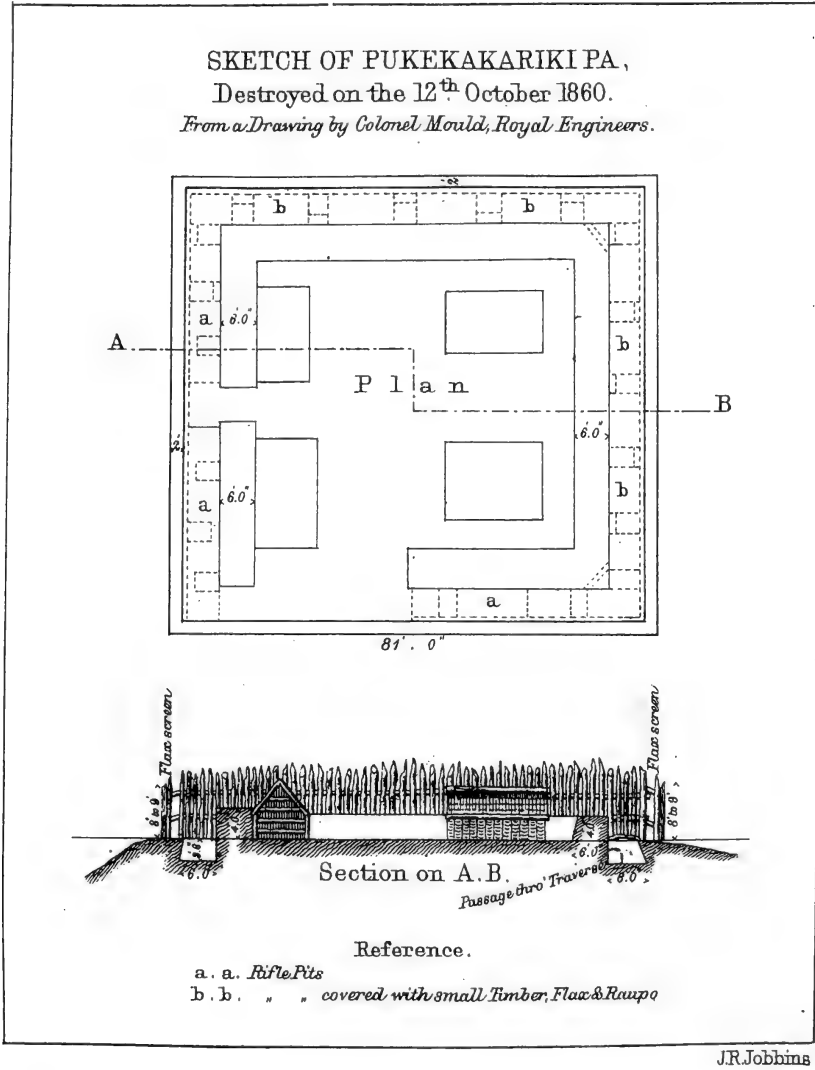


Fig. 31. ‘Sketch of Pukekakariki Pa, Destroyed on the 12th October 1860. From a drawing by Colonel Mould, Royal Engineers.’ (Pasley 1863).

Difficult to follow beneath all this was a trench or series of pits, *ca* 1 m deep at the front and 2–2.5 m deep at the rear. On Mould's plan is the remark, "The interior space was covered with Wharres". The field evidence suggests these covered bomb-proof shelters. The rear of the pa is *ca* 3 m higher than the forward bastion.

### *Pukekakariki*

The plan published by Captain Pasley (Fig. 31) shows Pukekakariki to have been *ca* 25 m square, enclosing an area 22 x 21 m (*ca* 460 m<sup>2</sup>). It is defended by two 8–9 ft (2.4–2.7 m) palisades and a flax screen. Inside are rifle pits 3 ft 6 inches (1.05 m) deep and 6 ft (1.8 m) across, backed by an earth bank 6 ft wide and 4 ft (1.2 m) high. Two sides appear to have had open rifle pits, and two – presumably the northern forward faces where an attack might be expected – had pits covered with timber and flax. Four huts are shown inside.

Pukekakariki is on a low hill with easy approaches, *ca* 10 m above the surrounding terrace country, south of the seaward end of Hampton Road. The site has been largely destroyed by construction of a farm house and other buildings on the northern slope of the hill. Remaining surface features show rifle pits along what was the west side of the pa, immediately outside the garden fence (Fig. 32). There is an 8 m gap between two surviving traverses. When the writer visited in June 1993 recent earthworks had cut into the south end of this side of the pa beside the main farm race, to reveal two infilled trenches or pits in the clean new section.



Fig. 32. Pukekakariki, showing the zig-zag rifle trench and two traverses, 1993.



Fig. 33. 1950 aerial photograph showing Mataiaio, the main Camp Parawaha entrenchment (left of road above label), part of Pukekakariki (since largely destroyed), and the locations of Orongomaihangī and Sap. On the coast is the historic pa, Parawaha. The old coast road can be seen between the pa and Pratt's 1860 camp. (New Zealand Aerial Mapping, 1790/3.)

### *Mataiaio*

Mataiaio was also a rectangular fortification. Surface evidence has been largely destroyed by ploughing, although the defensive ditch may still be traced on the ground, or seen from the air when conditions allow (Fig. 33). Field evidence shows the pa to have been *ca* 30 x 50 m in plan, 1–200 m south–east of the position given in Colonel Mould’s map. An escape trench connects Mataiaio with the outer defensive ditch of a much older pa which cut off a nearby sharp bend of the Kaihihi River (Prickett 1983:32–35).

### *Camp Parawaha*

Writing to the Military Secretary, Auckland, on 12 October, Pratt gives his address as “Camp Parawaha” (War Office 0270.II:30). The position was defended by three lengths of defensive earthworks thrown up around a wide area separated by gullies (see Fig. 29). William Grayling (*Taranaki Herald* 20 October 1860) gives the disposition of troops at Camp Parawaha, and labels the strongpoint over the gully to the south “Fort Urquhart”, after the officer in charge.

Of the Camp Parawaha earthworks only the long central section can still be seen, despite much cultivation, as it crosses the broad terrace at the end of Hampton Road (Fig. 33). Porikapa’s pa Parawaha, which was occupied by the Maori force accompanying Pratt, is still in good order on the coast nearby. (And is described on pages 16–19 in my 1983 report on pa in the Okato district).

### *Orongomaihangī sap*

The map of operations on the Kaihihi River shows a considerable length of sap and parallel for little more than a day’s work. Colonel Mould, in charge of the Royal Engineers at Kaihihi River, describes working and covering parties and the guns brought up when parallels had been prepared (Mould 1863:96–99). No surface evidence remains of the sap, with the possible exception of faint indications of part of the parallel on high ground next to the river, *ca* 200 m in front of Orongomaihangī.

## MAHOETAHI

The last five months of the 1860–61 war were fought north of New Plymouth. In late October it was decided to secure the Devon Road from New Plymouth to Waitara by establishment of a position on the low hill and old pa known as ‘Mahoetahi’, which stood between the Waiongana and Mangaoraka Streams, seaward of the road (GBPP 1861:166). The troops had already camped there once, on the night of 10 September prior to the advance on Huirangi and Kairau. On 27 October Colonel Mould took 200 men from Waitara to reconnoitre the site.

Early in November Mould again went from Waitara, to make a bridge over a swamp on Devon Road near the Waiongana River, close to the proposed stockade site. His men came under fire, however, and when a day was fixed for beginning work on the stockade an enemy force already occupied the hill. On 6 November a brief but bloody engagement saw the Ngati

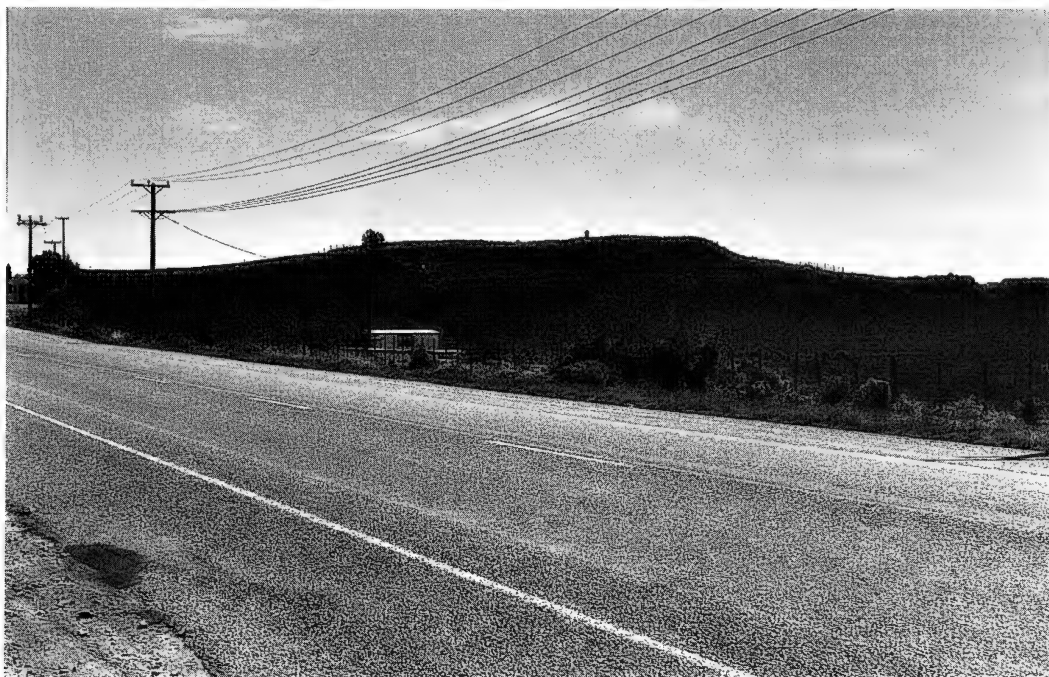


Fig. 34. Mahoetahi from the east. The central part of the pa is in the small hill top reserve, 1987.

Haua and Ngati Maniapoto force, only recently arrived in Taranaki, chased from an unprepared position. This was the first and most decisive Pakeha success of the war.

### *Mahoetahi*

Mahoetahi is situated immediately north of Devon Road (State Highway 3) at the junction with State Highway 3A (Fig. 34). The top of the hill is now public reserve. There is a New Zealand Historic Places Trust plaque at the roadside. Figure 35 gives an important plan of the hill by the surveyor Thomas Humphries, showing the location of Maori huts and defensive trenches on 6 November 1860. There appears to have been little by way of rifle pits, stockade or other defensive works.

After the engagement Colonel Mould was left at Mahoetahi with 300 men who entrenched and strengthened the Maori position before starting work on a stockade nearby. The troops destroyed the Mahoetahi defences on leaving. Terraces, especially visible on the eastern side of the hill, are all that remains.

### *Mahoetahi Stockade*

After the engagement the site of the stockade was changed from Mahoetahi to the nearby old pa Ngapuketuru, then marked by seven terraces beneath karaka trees on two adjacent lahar on the left bank of the Waiongana River (*Taranaki Herald* 24 November 1860). Construction proceeded rapidly:





Fig. 35. 'Mahoetahi', showing location of huts and unfinished stockade. (Thomas Humphries, Fieldbook 3030, DOSLI, New Plymouth.)

“7th November to 12 November. – From this date to the 12th, a party of 40 men were employed in felling and preparing timber for the stockade, clearing the bush from the intended site, and improving the defences of the pah [Mahoetahi], the working party for the stockade being covered by an advance line of skirmishers. on the 10th, 50 men of the garrison were ordered to New Plymouth.

13th November to 16th November. – Commenced the construction of the stockade on Ngapuke–turna [sic], which was closed in on the morning of the 16th, and on that night was occupied by a guard of 30 men. During the same period working parties were employed in clearing the great mass of timber and bush that covered the knoll, and levelling the old Maori banks that surrounded it.

17th November to 27th November. – Constructing barracks, stores &c., within the stockade, and clearing bush round the knoll and on the banks of the Waiongona River; working parties 40 men daily, with 8 Royal Engineers, and Military Artificers...

28th November. – The garrison at Mahotaki [sic] was broken up, the troops returning to New Plymouth, and the Commanding Royal Engineer to the Waitara. Previous to evacuating the pah, the whole of the entrenchments were levelled. The Maori “whares”, which served as shelter for a portion of the troops, were left standing. One officer and 40 men were left to garrison the stockade.”

(Mould 1863:100–101)

Working and defensive parties at Mahoetahi on 19 November comprised 289 men, mostly regulars of the 12th, 40th and 65th Regiments (Carey 1863:140).

The Ngapuketurua position was named ‘Mahoetahi Stockade’. Colonel Carey (1863:163, 172) gives the garrison on 20 January 1861 as 32 and on 11 February as 31 men. After the March 1861 ceasefire the post was maintained to keep open communication with Waitara. At the end of December 1862 25 of the 57th under Ensign A.B. Duncan, and possibly some local men, were at the post (Warre 1878:164–165).

Mahoetahi was abandoned on 13 May 1863 following the decision to withdraw from Waitara. One officer and 25 rank and file of the 70th Regiment returned to New Plymouth (War Office 0270.I:34). The position was then occupied by Te Atiawa under Mahau (AJHR 1864 E–3). It was reoccupied in the Second Taranaki War when the post was greatly enlarged by an earth breastwork thrown up around the summit of the second knoll. A 10 October 1864 sketch by Colonel Warre, in the Alexander Turnbull Library, shows the redoubt and stockade with a large encampment on adjacent lower ground (see Prickett 1981:77).

A drawing by the surveyor Thomas Humphries depicts a small stockade with signal mast on top of the higher of two hills that make up Ngapuketurua (Fig. 36). The site is located just south of Devon Road between State Highway 3A and the Waiongana River, where the stockade is marked by a platform *ca* 12 m in diameter. There are some possible terraces on the north slope. The south side of the hill has been quarried away.

## THE FINAL PHASE

Throughout December the troops at Waitara were employed preparing gabions, sap rollers and fascines (Mould 1863:101). At the end of the month an operation was begun aimed at destroying Maori strongholds south of the Waitara River. General Pratt assembled a large



Fig. 36. 'Ngapuketuru' (i.e. Mahoetahi Stockade), showing small timber work with flanking defence and signal mast. (Thomas Humphries, Fieldbook 3030, DOSLI, New Plymouth.)

force of Royal Artillery and Engineers, 12th, 40th and 65th Regiments and Naval Brigade. Early in the morning of 29 December he marched from Waitara out to Kairau, where the first of a series of eight redoubts was built under heavy fire (Figs 37 and 38).

#### *No 1 (Kairau) Redoubt*

The first British army fort thrown up in the advance on Huirangi was No 1 Redoubt, or 'Kairau' after the Maori settlement which once occupied the site. (Mentioned above in connection with the September operations in the area). Colonel Mould gives an account of engineering work carried out in the operations near Waitara which is unique in records of the New Zealand Wars.

"29th December.— A column of 900 men of all arms with four guns and howitzers, marched at 3 3/4 A.M., and having arrived at the site of the old Kairau pah (destroyed on the 11th September) about 1100 yards distant from Matarikoriko, a redoubt, for the accommodation of about 500 men was commenced for the purpose of serving as a depot for the attack of the pah, and subsequently for that of the position of Huirangi. Working parties of 150 men were employed. About 9 A.M. a volley of musquetry was fired from concealed rifle pits on the brink of a deep wooded gully, about 150 yds, from the redoubt, which for a moment interrupted its progress, but it was immediately resumed and carried on under a brisk fire from the enemy until 6 P.M., when it was completely closed in. 480 men were left as its garrison, who were on the alert the whole night, the enemy keeping up an almost unintermittent fire until four o'clock the following morning.

30th December (Sunday).— The parapets of the redoubt were this day raised and improved, banquettes formed, barbettes for guns raised, platforms for two 8-inch guns laid, and the guns mounted on the left face of the redoubt, pointing towards Matarikoriki [sic]."

(Mould 1863:101)

Lieutenant Colonel J.E. Alexander, 12th Regiment, adds details on the construction of the work:

“No.1 Redoubt was planned by Colonel Mould, and executed by Captain Mould with Royal Engineers and working parties, raising the parapets with earth and cut fern in layers, which last binds the loose earth in a wonderful manner, as we afterwards observed, and allowing of perpendicular parapets difficult to scale, and not the usual sloping parapets.”

(Alexander 1863b:232–233)

On the night of 29 December the redoubt was garrisoned by men of the 40th Regiment, a company of the 12th, and detachments of Royal Artillery, Engineers and Naval Brigade, all under Colonel A. Leslie, 40th Regiment (Carey 1863:153; Grayling 1862:47). Next day the 65th Regiment with Lieutenant Colonel A.F.W. Wyatt in command, plus some of the 12th,

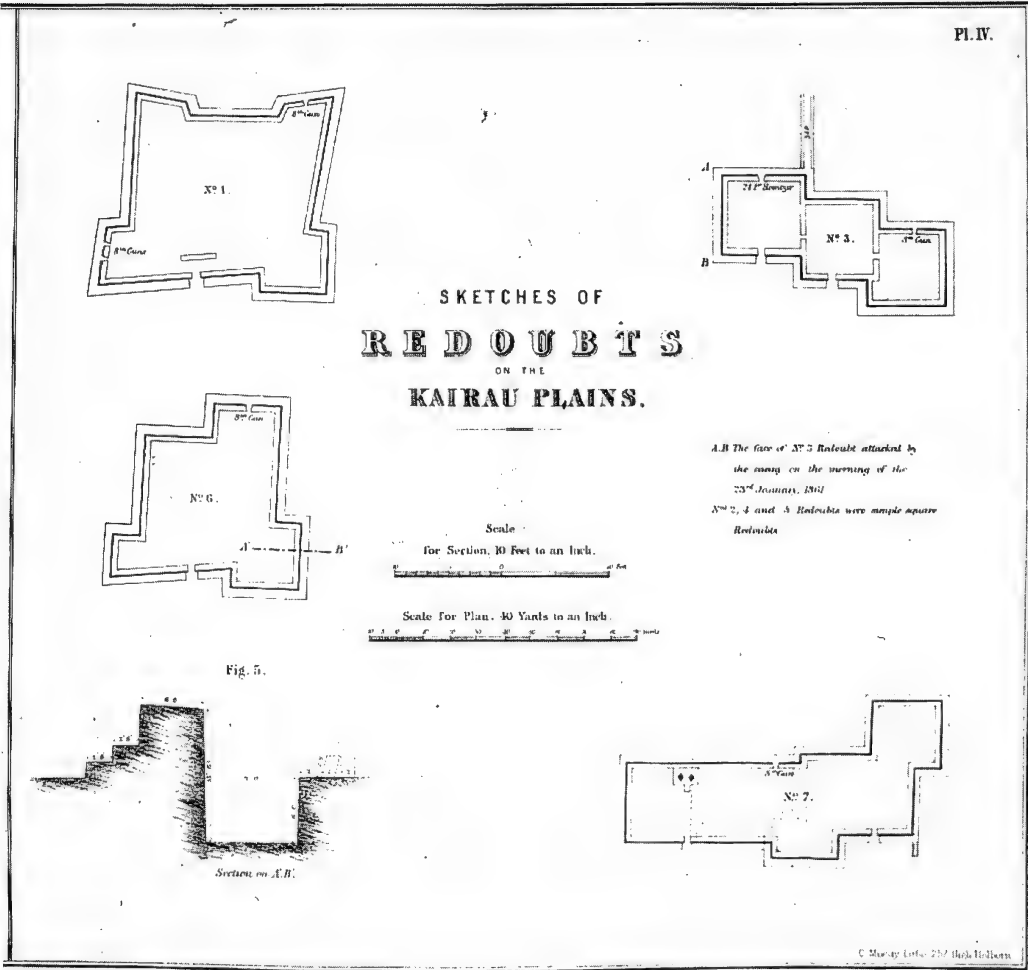


Fig. 37. ‘Sketches of redoubts on the Kairau Plains’. Plans of Numbers 1, 3, 6 and 7 Redoubts, and standard section through defences (Mould 1863).

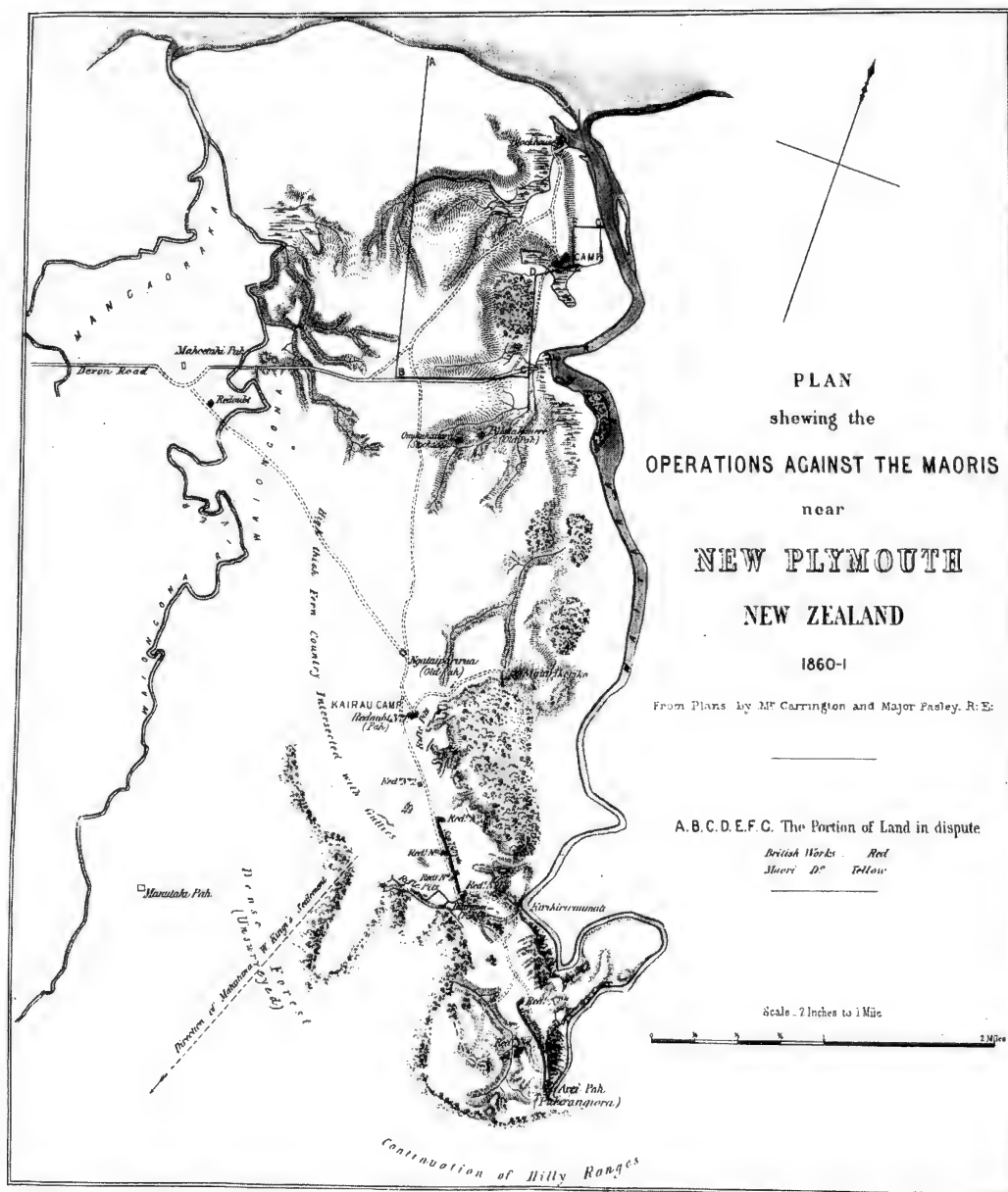


Fig. 38. 'Plan showing the operations against the Maoris near New Plymouth New Zealand 1860-1.' This map marks the disputed land at Waitara, Onukukaitara and Puketakauere, the redoubts and saps to Huirangi and Te Arei, Maori rifle pits, roads, etc. (War Office 0270.II:25.)

relieved the 40th as garrison (Carey 1863:153). On the eve of the 23 January attack on No 3 Redoubt the Kairau garrison still stood at 450 men. On 2 February Colonel Wyatt moved forward with the 65th to take command of No 6 Redoubt. On 11 February the No 1 Redoubt garrison was 371 (Carey 1863:172).

Kairau was occupied for a short time after the ceasefire of 19 March, the garrison at the end of March being provided by the 57th Regiment under Major Logan, recently arrived in New Zealand (*Taranaki Herald* 13 April 1861). The post was abandoned on 11 April, along with Nos 6 and 7 Redoubts (Grayling Journal 11 April 1861; Broughton 1914:58 gives 10 April).

A plan of No 1 Redoubt by Colonel Mould is included in Figure 37. It shows a large, basically square work with angled defence. Colonel Carey (1863:152) says the work, "...was of an irregular half bastion trace, and had an area of about 2,560 yards".

Half-way between the Matarikoriko and Te Arei Road corners, Waitara Road cuts through the centre of Kairau Redoubt. When last visited in July 1993, close cropping by horses showed up *ca* 50 m of the left rear angle of the redoubt, filled in to 200–400 mm depth, east of the road immediately behind a notice which marks the old fort. This part of the work can be seen in the New Zealand Aerial Mapping Ltd aerial photograph 4335/9, taken in November 1970.

### *Matarikoriko*

Matarikoriko was first occupied by a Maori force on 25 November 1860 (Mould 1863:101). On 1 December the *Taranaki Herald* reported that,

"...the Waikatos had erected two pas, one about 1300 yards from Puketakauere. Both are in open country, the first, Matarikoriko, being nearly in line with Ngataiparirua and the river Waitara, situate on the top of the slope to the river. The second, Kerikeriraumati, is a short distance outside the small bush to the left of Huirangi, and about 50 [sic 500?] yards from Matarikoriko. Both pas are pregnable, and it is believed intentionally so, as a ruse to entice the troops to attack them, while from numerous rifle pits and flanking parties in the vicinity, the chief resistance would be offered."

Later the Maori garrison at Matarikoriko erected a mast and arm on which they ran up a mock telegraph in imitation of the Pakeha posts at Puketakauere and Waitara (*Taranaki Herald* 15 December 1860).

Colonel Alexander (1863b:236–237) gives the lengths of rifle trenches outside Matarikoriko as 32, 74, 104, 73 and 178 paces. Carey (1863:149–150, 155) describes two types of rifle pit: those on the edge of scarp to the Waitara River valley, and others on the slope of the Matarikoriko hill itself. The latter had trenches for escape to the rear and in many cases were connected underground. Successive lines of pits presented a formidable obstacle to attacking troops. Matarikoriko was abandoned during the night of 31 December and promptly occupied by British troops.

The pa was located at the high point of today's Matarikoriko Road, where archaeological remains are those of the later Pakeha stockade. A search for nearby rifle pits may be guided

by Figure 38 which shows two near Matarikoriko, and more left of Kairau and south along the scarp to 'Kirikiriraumati'. The latter pa was close to the left bank of the Waitara River near Huirangi (see Figs 28 and 38).

### *Matarikoriko Stockade*

Matarikoriko was General Pratt's first objective when he marched out of Waitara on 29 December. Early on the morning of the 30th a truce flag was raised at the pa, which the following day was found to have been abandoned. Mould writes,

"It was immediately taken possession of, and preparations were commenced for constructing a stockade on the site. 100 men with a howitzer were posted as garrison within the pah.

1st January to 9 January, 1861.— Working parties, about 60 in number, were engaged in the construction of a stockade on Matarikoriki [sic], and in the destruction of the enemy's rifle pits, and in clearing the vicinity of the post from scrub and high fern...

11th January to 13th January.— The stockade on Matarikoriko was proceeded with on this and the three following days. The garrison was fixed at 60 men. The stockade was similar in construction and arrangement to that on Onukukaitea [sic], but a little larger to accommodate more men."

(Mould 1863:102)

The stockade was erected under the direction of Captain Mould and Lieutenant Warburton of the Royal Engineers (*Taranaki Herald* 12 January 1861). Tree ferns provided easily worked timber for its construction (Carey 1863:157).

Matarikoriko Stockade was held throughout by the 65th with small detachments from other corps. At first Captain Strange was in command (*Taranaki Herald* 5 January 1860). One the eve of the attack on No 3 Redoubt there was a garrison of 114, and on the establishment of No 7 Redoubt on 10 February, 60 men (Carey 1863:163, 172). It was probably abandoned in the second week of April along with other posts in the vicinity.

At the end of May Matarikoriko Stockade was given over to Hapurona, prominent among supporters of Wiremu Kingi. Hapurona, "... was promised a salary of 100 Pounds a year for taking charge of it, really a bonus to keep him detached from the war party" (Mould 1869:13). When the Second Taranaki War began, Hapurona was still there, and threatening to destroy the stockade for timber to construct whare and defences at Te Arei (AJHR 1863 E-3).

Figure 39 shows a rectangular stockade with blockhouses at two angles flanking all four sides. At the two remaining angles small sentry boxes or lookout posts are elevated above the loopholed stockade wall. Inside is a flag pole with signal arm. On page 21 in Fieldbook W1 (DOSLI, New Plymouth) is a plan of the work showing covered buildings on two sides of a central yard.

Matarikoriko Stockade is situated on high ground on the north side of Matarikoriko Road. The stockade sat on a platform, ca 30 m square, encircled by a defensive ditch now ca 7 m across. Since the mid-1970s an urupa, formerly on the northern flank of the site, has been extended to take up part of the stockade platform as well. Taranaki archaeologist Alastair Buist photographed the site in 1963 to show gorse on a largely intact platform and ditch

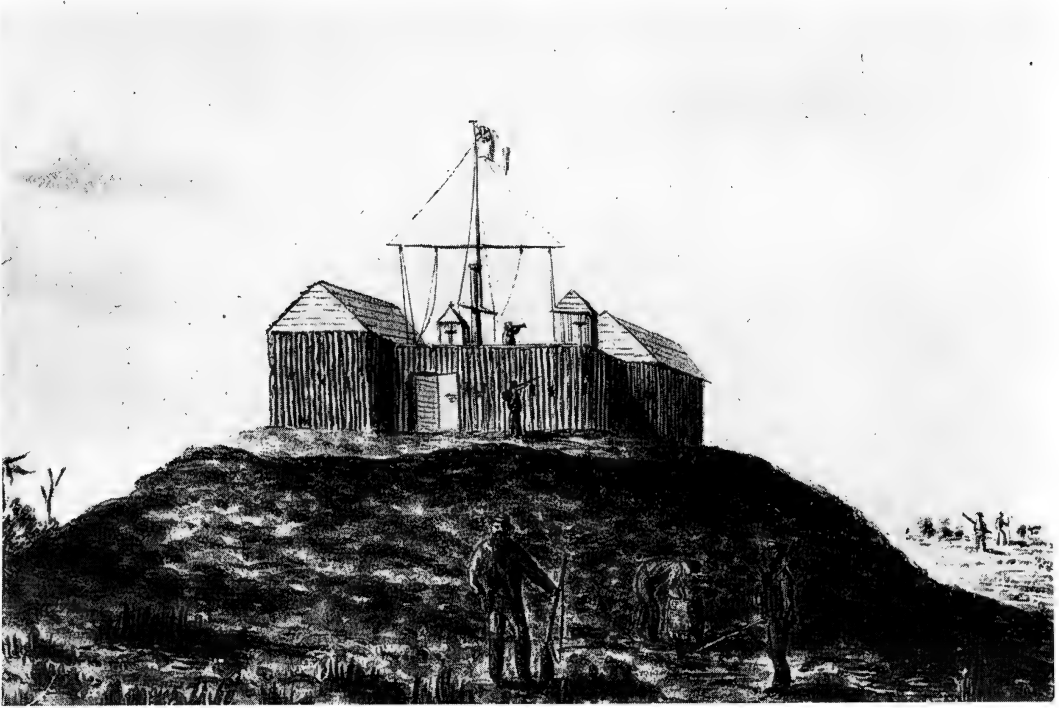


Fig. 39. Matarikoriko Stockade, showing loopholed stockade with flanking defence and signal mast. (After a sketch by Lt H.S. Bates, Cowan Collection, Alexander Turnbull Library.)

(Fig. 40). Since then the site has been greatly damaged, apparently through tidying-up operations carried out by bulldozer.

### *No 2 Redoubt*

The best account of the establishment of No 2 Redoubt is by Colonel Alexander.

“At three A.M. on the 14th January, a force six hundred strong, composed of men of the 12th, 14th and 40th regiments and Naval brigade, under the command of General Pratt, left the Waitara camp, and being joined by Colonel Wyatt and a party of the 65th regiment from Kairau, advanced in the direction of Huirangi, where and across the road the enemy had their rifle pits, extending a mile and a half in length. On the approach of the troops, partly in skirmishing order, the Maories were observed hurrying from their wharres in the rear to line their entrenchments, and immediately commenced a heavy fusillade on the troops, which was replied to by great guns from the redoubt and the rifles of the skirmishers. Colonel Mould, in the meantime, traced out and commenced six hundred yards in advance of Kairau, No 2 redoubt, twenty-six yards square, and built of earth and fern leaves mixed and rammed, it was completed before dark, and Captain Bowdler, 40th, and a party of one hundred and twenty men left to garrison it, with a 24-lb. howitzer “en barbette.””

(Alexander 1863b:247–248)

Royal Engineer, Colonel Mould, adds:



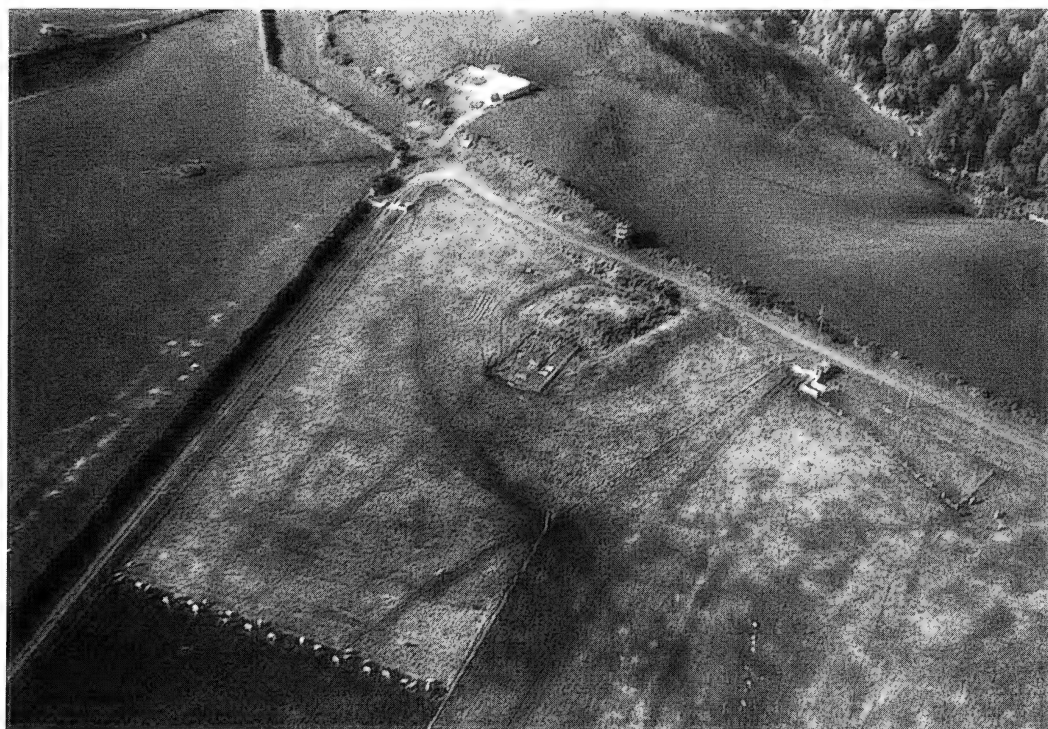


Fig. 40. Matarikoriko, aerial view from north-west. (A.G. Buist photograph, 1963.)

“14th January.—Commenced the construction of a redoubt about 500 yards on the right front of No. 1 or the Kairau redoubt, 26 yards square interiorly, which was completed in about 11 hours. The parapet was about 7 feet high, and averaged 6 feet thick. Banquettes were formed and a barbette raised for a howitzer on the right front salient angle. Working party, 60 men, with a detail of the Royal Engineers. The redoubt was garrisoned with 128 men, including artillery.”

(Mould 1863:102)

Grayling (1862:49) puts it 570 yards in advance of No 1 Redoubt, and Carey (1863:161), 600 yards.

Captain Bowdler, 40th, was in command of 110 of his own regiment, 26 of the 65th, and eight artillerymen with a 9-pounder (*Taranaki Herald* 19 January 1861). The redoubt was closed up and abandoned on 30 January (*Taranaki Herald* 2 February 1861), and was thrown down along with Nos 3, 4 and 5 Redoubts on 11 February (*Taranaki Herald* ‘Extra’ 11 February 1861). A watercolour by Lieutenant Bates shows Nos 2 and 3 Redoubts in front of the Huirangi bush edge (Fig. 41).

The location of No 2 Redoubt is given on the old Survey District Series cadastral map, Waitara TN15, 1938. It was *ca* 100 m east of Te Arei Road, 100 m south of the junction with Waitara Road. Today a hedge at right angles to the road dips into a slight depression to mark the site. No 2 is the only one of eight redoubts thrown up in the advance on Huirangi and Te

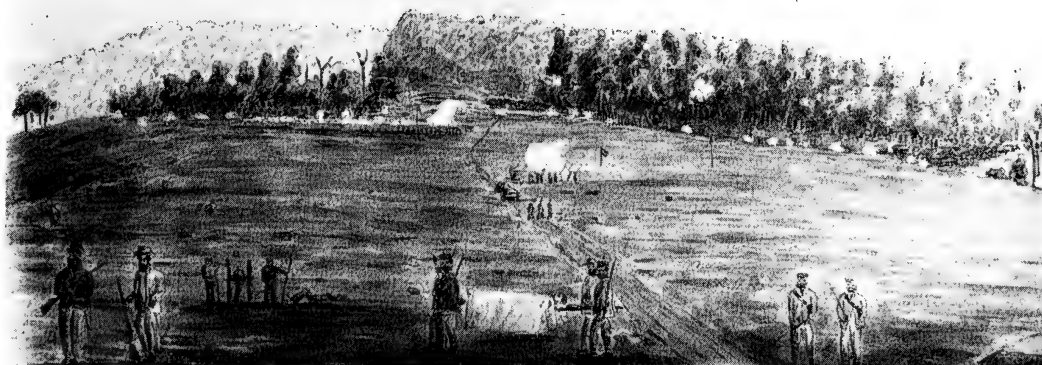


Fig. 41. No 2 Redoubt can be seen right of the road. Further away, left of the road, is No 3 Redoubt. Puffs of smoke can be seen from Maori rifle pits along the bush edge right and left of No 3 Redoubt. In the centre distance is Te Arei pa. (After a sketch by Lt H.S. Bates, Cowan Collection, Alexander Turnbull Library.)

Arei for which we do not have a plan from historical sources. Colonel Mould gives the size as 26 yard (23.8 m) square interior size and writes of a “right front salient angle”.

### *No 3 Redoubt*

The *Taranaki Herald* of 19 January reports the move to establish No 3 Redoubt.

“A force of upwards of 1000 men of the Naval Brigade, under Commodore Seymour, of the 12th, under Capt. Miller, 14th, under Major Douglass, 40th, under Colonel Leslie, and 65th, under Colonel Wyatt, commanded by the General in person, proceeded at 4 A.M. to-day to throw forward another redoubt...A smart fire of rifles was maintained, with a tremendous cannonade from 2 8-inch guns (one in the Kairau redoubt, and another planted in the road between No 2 redoubt and the enemy’s position), 3 24-pounder howitzers, 1 12-pounder howitzer (Naval Brigade), 1 9-pounder gun, a rocket tube (24-pounder), and a cohorn mortar. Under this fire, for whenever a puff of smoke was seen from the rifle pits, a shell was immediately thrown over it, Colonel Mould, R.E. selected a site for another redoubt, to the left of the road, about 1000 yards from Kairau redoubt, 550 from No. 2 redoubt, and about 700 from the enemy’s rifle-pits and position.”

Again Colonel Mould is in charge of construction.

“18th January.— A redoubt 30 yards square interiorly was commenced about 400 yards to the left front of No. 2, and completed in 1 1/2 hours and was occupied at night by a garrison of

100 men, one howitzer was mounted “en barbette” at one angle of the work, and a second placed in an embrasure. Working party, 60 men, with a detail of Royal Engineers...

19th January.— A right wing to Redoubt No. 3 was commenced and nearly completed during the day, a working party of 60 men being employed. A platform for an 8-inch gun was laid on the right front face of the wing, and the gun mounted. Occasional firing from the enemy.

20th January.— The right wing of the redoubt commenced yesterday, was completed this day, and a communication made between it and the centre. A left wing was also commenced and the front face completed and part of the left face. There was not any interruption from the enemy.

21st January.— The left wing of the redoubt was carried on this day nearly to completion by working parties of the same strength as on previous days. The garrison was strengthened by 100 men, who were posted in the right wing of the redoubt. The enemy occasionally fired briskly but caused only one slight casualty.

22nd January.— The left wing of the redoubt was completed this day and an additional garrison place in it, including the head-quarters of the 40th Regiment.”

(Mould 1863:102–103)

Grayling (1862:80) says it was 430 yards from No 2 Redoubt. The initial garrison of 100 men and a howitzer was under command of Captain Richards, 40th Regiment (*Taranaki Herald* 19 January 1861). Additions to the garrison on completion of the right and left wings are outlined by Mould.

No 3 Redoubt consisted of three squares *en echelon*, left forward, as shown on Colonel Mould’s plan. In his discussion of the work Colonel Carey describes construction of the walls of earthwork redoubts in Taranaki.

“The ground in which the men worked was very favourable, but the soil alone would never have stood at the required slope had we not been able to strengthen it with fern. This pulled up by the roots, or cut down close to the ground, and and when laid down on the space marked out for the parapets, and at right angles to its length, each bundle overlapped the other. Alternate layers of earth and fern completed the work, and thus a strong and nearly perpendicular and enduring parapet was rapidly raised.”

(Carey 1863:161–162)

On the morning of 23 January No 3 Redoubt was attacked by a large Maori force, one of a handful of Maori assaults on Pakeha fortifications in the New Zealand Wars. The garrison at this time comprised 341 of the 40th (officers and men), 22 Royal Artillery, 22 Royal Engineers and 11 Naval Brigade, and included the headquarters of the 40th Regiment under Colonel Leslie. Pratt includes Leslie’s report in his despatch of 23 January 1861 (GBPP 1862:10–12). During the attack a company of the 12th and two of the 65th came up from Kairau Redoubt. The Maori force was beaten off after bloody work in the surrounding ditch.

It was from No 3 Redoubt that on 22 January Pratt’s sap was begun for the centre of the line of Huirangi rifle pits. The redoubt was abandoned at 8 a.m. on 11 February when the headquarters of the 40th marched forward to No 7 Redoubt. It was thrown down the same day (*Taranaki Herald* 16 February 1861, and ‘Extra’ 11 February 1861). The work can be seen in the middle distance in Figure 41.

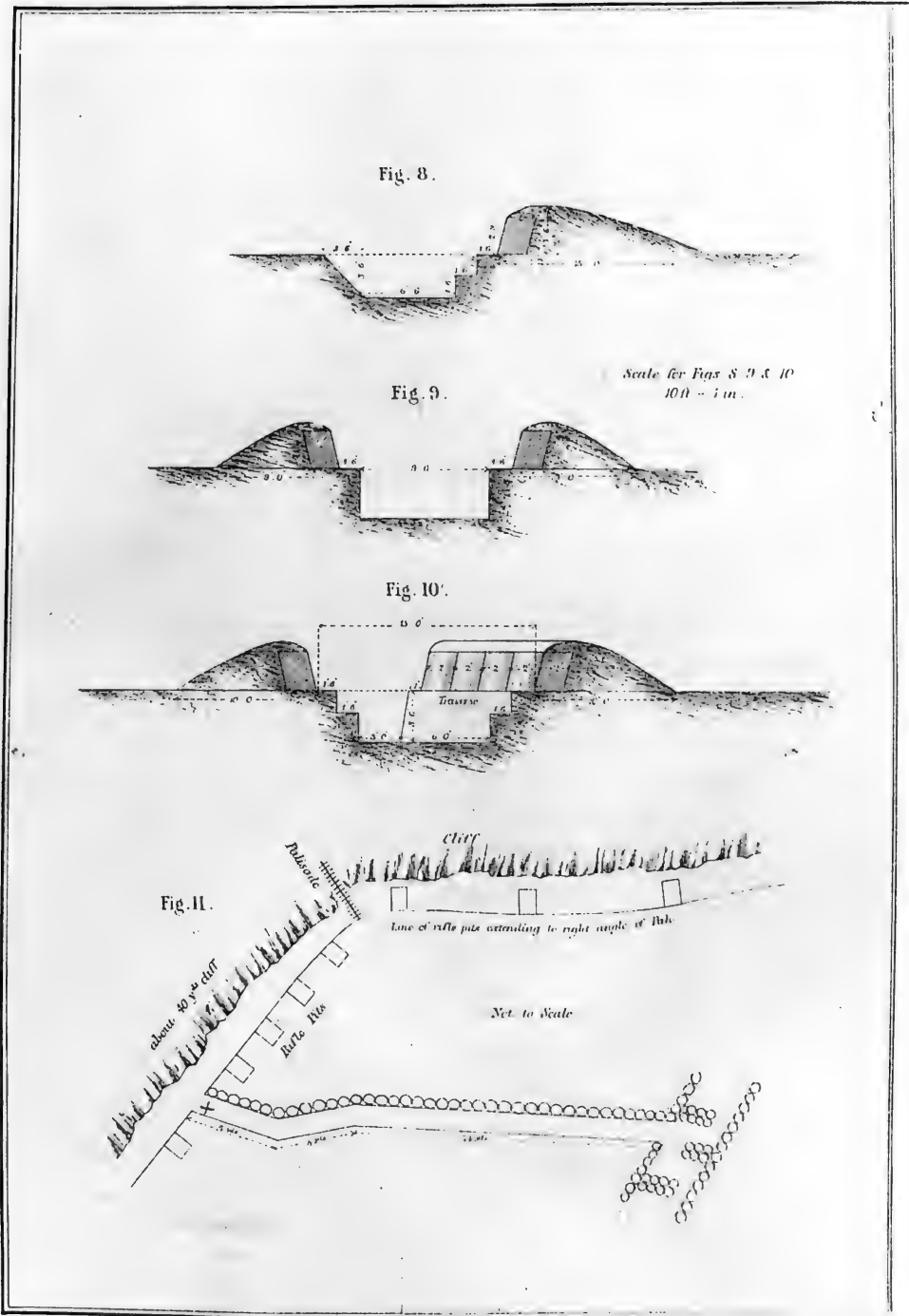


Fig. 42. Sections and plan of General Pratt's sap (Mould 1863). Sections show single sap ('Fig. 8'), double sap ('Fig. 9'), and double sap with traverse ('Fig. 10'). Plan shows the head of the sap at Te Arei, demi-parallel to the cliff, and Maori rifle pits.

The location of No 3 Redoubt is given on the old Survey District Series cadastral map, Waitara TN15, 1938. Only three or four short lengths of badly damaged and eroded defences can now be seen. These lie within and, in one case, just outside the present homestead garden on the site.

### *Pratt's Sap*

Two saps – attacking trenches – were dug by the troops: the first to turn Te Atiawa and their allies from rifle pits at the Huirangi bush edge; the second carried the advance on to Te Arei, high on the northern face of the historic pa, Pukerangiora. The two lengths of sap totalled 1626 yards (1487 m).

The first sap extended from No 3 Redoubt to 90 yards in advance of No 6 Redoubt on the line of the Huirangi rifle pits. Colonel Mould, who was in charge of engineering works throughout the advance, gives the length as 768 yards of double sap to No 6 Redoubt, plus 90 yards of single sap beyond (War Office 0270.II:48–50). A double sap employed gabions on both sides, while a single sap had them on one side only (see Fig. 42). For the first 120 yards the double sap was 12 ft wide, and beyond that 15 ft, traversed at intervals of 40 or 50 ft.

It is not difficult to follow the line of the sap from the site of No 3 Redoubt to No 6 Redoubt on the corner of Te Arei and Bertrand Roads. The sap shows up clearly from the air and on the ground (Figs 43 and 44), despite much ploughing over the years.



Fig. 43. The sap showing up under new grass in 1975. View from north towards No 6 Redoubt at the far corner of the paddock.

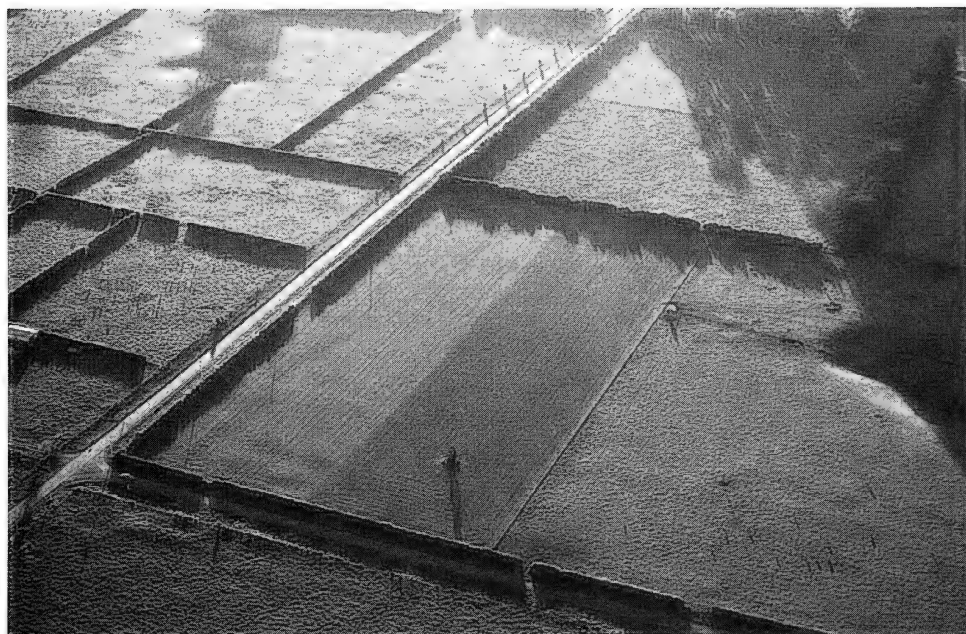


Fig. 44. Aerial view of sap looking north. Huirangi Redoubt can be seen bottom left at the corner of Bertrand and Te Arei Roads, with the sap faintly visible running across two paddocks to trees at upper right, 1975.

The second sap extended from No 7 Redoubt to within 90 yards of the Maori position at Te Arei. From No 7 to No 8 Redoubt was a single sap of 452 yards. Beyond No 8 Redoubt was a double sap of 316 yards where the ground fell away to dangerously expose the attacking troops, before rising again to the enemy defences. Figure 42 shows a demi-parallel located to evict Maori snipers who occupied rifle pits at the cliff edge to the left (War Office 0270.II:48–50). This can be easily seen today (Fig. 45). Demi-parallels were trenches dug nearly parallel to the face of the enemy fortification for artillery positions or to allow a concentration of troops.

A watercolour by Taranaki settler F.H. Arden depicts the sap at Te Arei after the March ceasefire (Fig. 46). The Te Arei defences can be seen against the bush in the background. Demi-parallel extends out of the picture to the left. Most of the No 7 Redoubt to Te Arei sap is no longer visible. A short section in the Pukerangiora Historical Reserve is still in good order and is a unique archaeological site. The sap and demi-parallel have in recent years been cleared of vegetation (Fig. 47).

### *Huirangi*

General Pratt wrote on 6 February 1861:

“I have the honour to report that on the 2d instant we took possession of the enemy’s rifle-pits, extending over a mile in the line of bush, with Huirangi in the centre, and which they abandoned without a struggle.



Fig. 45. Demi-parallel at Te Arei, 1993.

For cultural reasons, this image has been removed.  
Please contact Auckland Museum for more information.

Fig. 46. The head of Pratt's sap just after the ceasefire of March 1861, showing demi-parallel to the left and Te Arei pa beyond. The wicker gabions can be seen, also the traverses which prevented an enfilading fire. (F.H. Arden, watercolour, Taranaki Museum.)





Fig. 47. Part of General Pratt's sap survives in Pukerangiora Historic Reserve, 1993. This view is in the opposite direction to the Arden watercolour.

A redoubt for 400 men has been erected there inside the space where the Huirangi pah stood which was destroyed on the 11th of September last.

The enemy appear to have retired to another line of defence further inland."

(GBPP 1861:36)

Alexander (1863b:235) describes the Huirangi rifle pits as narrow to avoid casualties from shot and shell, well designed for defence, and for escape if necessary. They were straight or curved, with traverses. Covered huts lined with fern gave shelter from enemy guns. In his 30 March 1861 report to the Deputy Adjutant General, Mould has this to say:

"Their sites are at the best but barely indicated by a narrow line of newly-moved earth, carefully spread, not exceeding six inches above the general surface of the ground, whilst, for the most part, they, as well as the defenders, are invisible, a head occasionally only being raised above the level of the ground to reconnoitre, though the line may be thickly occupied in the recent case, it is presumed, by a force at first amounting to nearly 1,200 men."

(War Office 0270.II:48-50)

The Huirangi rifle pits were about the line of Bertrand Road, and continued west of Te Arei Road. They are marked in Figure 38 with their back to the scarp which falls away to the Mangaonaia Stream. Some are located on the Waitara IX Block Sheet 47/11, north of Cross Road at the edge of the scarp to Mangaonaia Stream. In Figure 41 smoke from Maori guns can be seen along the bush edge on both sides of the gap which marks the location of Huirangi



itself. I have not searched the area. Archaeological remains may still exist where not destroyed by road works, cultivation or the steady erosion of farm animals or activities.

#### *No 4 Redoubt*

No 4 Redoubt was thrown up to defend the sap. Once again Colonel Mould provides the details.

“27th January.—Sap continued as yesterday with a detail of 4 Engineers and 30 Line, working from 5 A.M. till 7 P.M., 49 yards being executed. A square redoubt, 13 1/2 yards a side interiorly, was commenced at 5 A.M. on the right side of the sap, and carried on until 7 P.M. when it was nearly completed; 100 men were employed on this work from 5 A.M. until noon, and 70 men from noon until 7 P.M. The front of the redoubt, which was numbered 4, was 310 yards from the commencement of the sap. It was garrisoned by 50 men; Lieutenant Warburton, R.E., on duty.

28th January.—60 yards of the sap executed this day, between 5 A.M. and 7 P.M., with a party of 3 Engineers and 5 men of the Line; 2 Engineers and 25 men employed in taking down gabions, and reforming the parapets of the sap with fern, and 20 men in completing the banquette of No. 4 Redoubt, clearing out the ditch, the earth being thrown up to form a slight glacis, and planting palisades in the ditch.”

(Mould 1863:104)

The *Taranaki Herald* of 2 February 1861 puts No 4 Redoubt 266 yards forward of No 3.

The garrison of 50 men was under the command of Captain Robert Hare, 40th Regiment (*Taranaki Herald* 2 February 1861). No 4 Redoubt was abandoned on the advance to No 7 Redoubt on 10 February and was thrown down the following day (*Taranaki Herald* 16 February 1861 and ‘Extra’ 11 February 1861).

No 4 Redoubt is located on the old Survey District Series cadastral map, Waitara TN15. Of the eight redoubts put up during the advance on Huirangi and Te Arei, it is the only one of which no surface indication remains. It is, however, easy to follow the line of the sap, and quite possible to accurately locate the vanished work from contemporary information.

#### *No 5 Redoubt*

“30th January.—5 Engineers and 40 men employed on the sap from 5 A.M. until 7 P.M.; 71 yards executed, 2 Engineers and 30 men reforming sap with fern. At 3 P.M., a redoubt (No. 5), to be 24 yards square interiorly, was commenced on the left side of the sap, about 530 yards from the commencement of the sap, and 260 yards from the nearest of the enemy’s rifle pits. A screen, consisting of a double row of filled gabions with an empty row on the top, was previously placed in front of the front face of the redoubt. 3 Engineers and 30 men employed on this work.

31st January.—Sap continued as before; working party, who were employed from 5 A.M. until 8 P.M., 3 Engineers and 30 of the Line. Redoubt No. 5 was completed by 8 P.M., with banquettes complete, and a “barbette” for a 24-pounder howitzer on the left front angle, an average party of 8 Engineers and 100 men being employed. The enemy fired a little at different periods of the day.”

(Mould 1863:104)

The redoubt was designed for a garrison of 100 men (Carey 1863:168). It was abandoned on 10 February and thrown down the following day (*Taranaki Herald* 16 February 1861 and 'Extra' 11 February 1861).

No 5 Redoubt is marked on the old Survey District Series cadastral map, Waitara TN15. In a 1950 aerial photograph (New Zealand Aerial Mapping 1785/21) it can be seen that the sap has a slight change of direction as it enters the south side of the paddock at the Bertrand and Te Arei Roads corner. No 5 Redoubt is situated at this point. When visited by the writer in the mid-1970s, a single faint depression could be seen running off at right angles to the sap to mark the site of the work.

### *No 6 (Huirangi) Redoubt*

Colonel Carey describes the establishment of No 6 Redoubt:

"On the 2nd February the first line of [rifle] pits was reached and a redoubt for 450 men, two 24-pounders, and one 8-inch gun was commenced. it was completed next day, and garrisoned by the 65th Regiment, a portion of the Naval Brigade, Royal Artillery, and Royal Engineers."

(Carey 1863:169)

The Royal Engineer, Colonel Mould, again gives details:

"2nd February.— ...At 3 P.M. a redoubt was commenced, its front slightly in advance of the enemy's rifle pits, in the midst of a field of high Scotch thistle; and to the left of the Huirangi road its left front angle resting on a patch of close bush, extending away to the left and front.

3rd February.— ...The redoubt commenced yesterday was carried on throughout the day, from 5 A.M. till 7 P.M., 120 men in all being employed in the work.

4th February.— 11 Engineers and 120 men employed in completing No.6 Redoubt, which was garrisoned by the 65th Regiment, including its head quarters. 25 axe-men employed as yesterday in cutting down the bush. A platform for an 8-inch gun was laid in the right half bastion of the redoubt.

5th February.— A party of 80 men employed in forming banquettes in the redoubt, widening, deepening, and clearing the ditch, and partly raising the parapets, 25 axe-men employed as before; 12 Engineers superintending the several works."

(Mould 1863:105)

Huirangi Redoubt was occupied in the closing stages of the First Taranaki War by a detachment of the 65th including the headquarters of the regiment, plus some other troops. Colonel Wyatt moved forward from No 1 Redoubt to take command on 2 February. On the advance to No 7 Redoubt on 10 February, No 6 was held by 432 men (Carey 1863:172). At this time Nos 1, 6 and 7 Redoubts were the only fortifications occupied, all with strong garrisons.

Colonel Wyatt was in command at No 7 Redoubt on the night of 10 February (Broughton 1914:57). The next day Colonel Leslie led the 40th forward to No 7 Redoubt, and it is likely Colonel Wyatt then rejoined the head-quarters of his own regiment at Huirangi. Wyatt is certainly in command at No 6 on 21 March, two days after the ceasefire (Broughton 1914:57).

The 65th marched out from Huirangi on 11 April when the whole area was abandoned by the troops (Grayling Journal 11 April 1861).

No 6 Redoubt was the only one of eight built during Pratt's advance on Huirangi and Te Arei which was re-occupied in later campaigns. Captain Page's company of Taranaki Military Settlers took over the old post on 11 October 1864 to keep open communication with the 70th Regiment redoubt recently established at Te Arei (*Taranaki Herald* 15 October 1864).

No 6 Redoubt was a large redoubt with flanking defence at three angles covering all four sides (see Fig. 37). It is situated at the corner of Bertrand and Te Arei Roads (Fig. 48), where earthworks can be seen in the paddocks on both sides of Bertrand Road. How much the later occupation altered original earthworks is not clear. A rough plan by S.P. Smith, dated 3 April 1865, shows a change to the flanking defence on the forward (southern) face (page 16, Fieldbook W1, DOSLI, New Plymouth). Most of the site has been destroyed by roading so that archaeological confirmation of the trace is not easy.

### *Te Arei*

Pratt described the "pahs and position" of the next line of defence as more formidable than he had contemplated and called for mortars (GBPP 1862:37). As at Huirangi there were



Fig. 48. The remains of No 6 Redoubt, at the corner of Te Arei and Bertrand Roads. 1975 photograph.

rifle pits at the bush edge on both sides of the troops line of advance. Strongpoints were at Te Arei, Pukerangiora and Te Tutu (GBPP 1862:44). Te Tutu was 6–700 m west of Te Arei over the valley of the Mangaonaia Stream, where the ridge is now crossed by York Road. Figure 38 shows a crescent of rifle pits along the high ground here. A 1934 cadastral ‘Map of Taranaki County’ shows rifle pits south–west of Te Tutu between present day York and Kelly Roads (Q19 *ca* 180367).

Alexander (1863b:274) describes a narrow shelf dug below the cliff top at Te Arei giving access to rifle pits left of the sap (shown by Mould in Fig. 42). The remains of rifle pits are still visible on the cliff edge in the Pukerangiora Historic Reserve (Fig. 49). A watercolour by Colonel Warre in the National Library of Australia shows the Te Arei defences in 1864. A light outer fence is backed by massive earthworks with ditches leading to firing trenches. Behind is a stockade. The earthwork which now occupies the Te Arei position is not the pa but a 70th Regiment redoubt dating from October 1864.

### *No 7 Redoubt*

Colonel Carey again gives a good account of the forward movement of troops.

“On the 10th February all the disposable force, 932 rank and file, paraded at No.6 Redoubt. The 40th took the left, the 65th, 12th, and 14th the right; the guns, ammunition, &c., the centre. The whole then moved to take up a position as near as could be done with regard to our communications with the redoubts...an advance was made to within about eight hundred yards of the enemy’s position. Here, from the rifle–pits, no enemy being visible, a heavy fire



Fig. 49. Rifle pit at cliff top, Te Arei, 1993.

was opened on the force. The skirmishers were thrown a little more forward and No.7 Redoubt was commenced, where the head of the column then rested.”

(Carey 1863:170–171)

No 7 Redoubt was built under the supervision of Colonel Mould and Captain Mould.

10th February.—Commenced the construction of a redoubt about 1,300 yards from No.6, and about 800 yards from Te-ari [sic] Pah (Puke-rangiora), about 8 A.M., employing 24 Engineers and 130 men of the Line, under cover of a line of skirmishers, supported by 4 guns and howitzers. The enemy opened fire from a line of rifle pits, in commanding positions, and from the pa, about 7 A.M., and fired briskly throughout the day, under which the work of the redoubt was carried on, and so far completed as to be occupied by a garrison at night. The garrison was 400 men, including the head quarters of the 40th Regiment...

11th February.—The works at the redoubt were continued; the parapets being raised, and ditches deepened, and the front face, and part of the left face, surmounted with filled gabions, with sandbag loop-holes at intervals, to protect the interior from the plunging fire of the enemy, which was sharply kept up, killing one man, and wounding an officer and one man within the redoubt; 9 Engineers employed superintending the working parties.

12th February.—The works of the redoubt were completed this day, 9 Engineers were employed in superintending and assisting the garrison...”

(Mould 1863:105–106)

No 7 Redoubt was on lower ground than the Maori positions on Te Arei so a considerable effort was put into raising the parapets on forward faces. The original work had two large bastions covering all four faces. This was soon enlarged:

“14th February.—...9 Engineers and 80 men of the Line employed in making an addition to the left of No.7 Redoubt, to give more accommodation.

15th February.—9 Engineers and 80 men employed in completing the addition to No.7 Redoubt, in draining the redoubt and opening a communication between the original and added portion.”

(Mould 1863:106)

From 18 to 25 February there was more raising of the parapets and deepening ditches. On 15 March a further addition was made.

“15th March. ...An addition to No.7 Redoubt, to contain the artillery, was commenced on the left by a party of 16 Engineers and 80 men of the Line...

16th March.—...The addition to the redoubt, which was 30 yards by 25 yards interiorly, was carried on and completed, with the exception of portions of the banquettes, and a “barbette”, 21 feet by 24 feet, was constructed for two Armstrong guns..

17th March.—...A party of 36 men was employed in completing the banquettes, &c., of the new portion of No.7 Redoubt.

18th March.—...The parapet between the old and added portions of No.7 Redoubt was broken down, the ditch filled in, and the “barbette” made up to 36 feet in width.”

(Mould 1863:109–110)

The successive additions can be seen in Colonel Mould’s plan (Fig. 37), and on the ground today (Fig. 50).



Fig. 50. No 7 Redoubt, aerial photograph from north, Te Arei Road at right, 1975.

On the night of 10 February No 7 Redoubt was occupied by 400 men (12th, 40th and 65th Regiments) drawn from rear redoubts, under the command of Colonel Wyatt (Broughton 1914:56). The following day No 3 Redoubt was abandoned, Colonel Leslie and the 40th moving to No 7, then occupied by 435 men (*Taranaki Herald* 16 February 1861; Carey 1863:172). The sap for Te Arei started from the redoubt on 16 February (Mould 1863:106). After the ceasefire the redoubt was occupied by the 40th with some Royal Artillery (*Taranaki Herald* 13 April 1861). No 7 was abandoned on 11 April 1861 (Grayling Journal 11 April 1861).

No 7 Redoubt is situated in the paddock north of the Te Arei and Tikorangi Road corner. The earthworks are badly damaged although still easily seen from the ground or air. A Thomas Humphries sketch depicts the redoubt with the Te Arei stockade beyond (Fig. 51).

#### *No 8 Redoubt*

During the night of 26 February 1861 the Maori garrison at Te Arei destroyed the forward part of the sap. The British command decided therefore to build a small guard redoubt 452 yards in advance of No 7 to protect the works.

“28th February.— To protect the further progress of the sap, a redoubt (square) to be of 16 yards interior side was commenced at 5 A.M., the front face thereof being 34 yards from the





Fig. 51. 'No 7 Redoubt', from the north, with tents inside and to rear. In the distance the stockade defences of Te Arei can be seen against the bush edge. (Thomas Humphries, Fieldbook 3030, DOSLI, New Plymouth.)

end of the single sap. A screen of gabions filled with earth was thrown up to cover the workmen, who were in number 7 Engineers and 80 of the Line. The Redoubt (No.8) was completed by 7 P.M., and occupied by a guard of 50 men. The upper row of gabions of the screen was taken down and the lower double row backed up with earth to form a glacis." (Mould 1863:107–108)

At the end of March No 8 Redoubt was garrisoned by a small detachment supplied in rotation by the regiments stationed at Nos 1, 6 and 7 Redoubts (*Taranaki Herald* 13 April 1861). It is not known precisely when it was abandoned, although it must have been between the end of March when the *New Zealander* correspondent visited the post (*Taranaki Herald* 13 April 1861), and 11 April when the troops vacated the entire area.

The location of No 8 Redoubt is accurately given on the relevant survey blocksheet, at a location given the name 'Okurawhero' (Waitara IX Block Sheet, DOSLI, New Plymouth; and see page 17, Fieldbook W1, where the name 'Onewhero' is given). It was situated on high ground east of Te Arei Road, adjacent to the road fence. The location is easily determined today, although cultivation has destroyed all sign of earthworks. The line of sap entering and leaving the redoubt, though not the fort itself, can be seen on the 1950 aerial photograph (New Zealand Aerial Mapping 1785/21).

## WAR'S END

In March 1861 the Ngati Haua leader Wiremu Tamihana (Tarapipipi) arrived at Te Arei to assist in bringing about a peace settlement. Negotiation took place over the lines ending on the morning of 19 March when a white flag was raised at the pa to signal the ceasefire. Next day the Waikato were observed from No 8 Redoubt, crossing the Waitara River on their way home. On 21 March the Ngati Ruanui and Taranaki people returned south from Waireka which they had reoccupied in the new year (*Taranaki Herald* 23 March 1861).

A peace agreement was then signed for Te Atiawa by Hapurona on 8 April, and by Wiremu Ngawaka Patukakariki a week later. Among other things the chiefs agreed to further investigation of the Waitara title, to give up plunder, and to submit to British law (AJHR 1861 E-18:4-5). Wiremu Kingi retired to Kihikihi with Ngati Maniapoto and did not sign (Cowan 1922-23 I:213). No settlement was made with southern tribes.

## FORTIFICATIONS AND WARFARE

In the Taranaki campaign of 1860-61 Pakeha forces erected no less than 31 campaigning and defensive positions. Fortified pa came to about the same figure, although some of them, including the several Bell Block pa, were already in existence before 1860. In a campaign which lasted just one year the forts of both sides represent a considerable investment of scarce resources.

## PAKEHA WORKS

European works were located to control battlefields, lines of communication, and military or farming frontiers. The First Taranaki War is unique in the New Zealand Wars in the use of Pakeha works for tactical offensive purposes, notably at Huirangi and Te Arei in early 1861. The only assault on a Pakeha work in the war of 1860-61 was that on No 3 Redoubt, where the attacking party was badly beaten. It must be remembered, however, that the success of Pakeha forts lay, not in their having withstood an attack, but in no assault being attempted. This is in marked contrast to Maori works.

Pakeha works varied considerably in size. Waitara Camp was one of the largest in all the New Zealand campaigns, comparable only with Queen's Redoubt, Pokeno, also enclosing *ca* 8500 m<sup>2</sup>. At *ca* 2500 m<sup>2</sup> (50 x 50 m) Waireka Camp is the largest redoubt of the war of 1860-61 for which we have archaeological evidence. Small works were No 5 Redoubt which enclosed 480 m<sup>2</sup> and No 8, 210 m<sup>2</sup>, in both cases using Colonel Mould's figures.

There is contradictory data for some of the 1861 redoubts near Waitara. Colonel Carey says that No 1 Redoubt, "...had an area of about 2,560 [square] yards", that is 2140 m<sup>2</sup>. From Colonel Mould's plan, however, the area may be estimated at *ca* 3300 m<sup>2</sup>. Similarly, Mould's official report (War Office 0270.II:48-50) gives the area of No 3 Redoubt as 1900 square yards; but he also says that the central square was "30 yards square interiorly" (27.5 m), and his plan shows left and right additions about the same size, making a total closer to 2700 square yards or 2270 m<sup>2</sup>. This figure is approximately confirmed by Mould's plan. From the same plans No 6 Redoubt may be estimated at *ca* 2200 m<sup>2</sup>, and No 7, *ca* 2700 m<sup>2</sup>. Only excavation will confirm these figures.



Maximum garrisons at the above fortifications are as follows: No 1 Redoubt, 450 men; No 3 Redoubt, 396; No 6 Redoubt, 432; No 7 Redoubt, 435; Waireka Camp, 265. An example of a small earthwork fortification is No 8 with 50 men only. In battlefield conditions as at Waitara in early 1861, and at Waireka Camp, manning levels were at a maximum.

Stockades were mostly small, like Omata where 260 m<sup>2</sup> was enclosed. The evidence suggests that Matarikoriko, Puketakauere and Mahoetahi were smaller again. Stockades and blockhouses, with accommodation against the perimeter defences, made more efficient use of space than earthwork redoubts which required space for tents and easy access to parapets in case of attack. Garrison figures include the Omata Stockade with a maximum of 80 men, Puketakauere, 19–50 men, and Mahoetahi, 30–40.

Engineers employed a variety of traces (ground plans) in laying out redoubts. The classic rectangle with bastion defence at two angles covering all four sides was used only at Waireka. In the advance on Huirangi and Te Arei all the large redoubts were laid out to a unique trace. At No 1 Redoubt were angled bastions with intervening curtain walls on the front face. This arrangement was designed to contend with artillery which might breach the curtain wall, hardly likely in New Zealand. There is no sign in the First Taranaki War of the so-called 'New Zealand redoubt' (see Young 1869), common in later campaigns. This was rectangular, with bastion defence at all four corners each covering one side only.

## MAORI WORKS

In contrast to Pakeha works, fortified Maori pa were located and built throughout the New Zealand Wars with the purpose of inviting attack. In this they achieved some success, notably at Ohaeawai in 1845, Gate Pa, Tauranga, in April 1863, Te Ngutu o te Manu and Moturoa, south Taranaki, in 1868, and at Puketakauere in June 1860. Their success, however, depended on a particular enemy response; alternatively they could be ignored or by-passed.

Maori engineers developed artillery proof fortifications from long experience of pre-European works and the musket pa of early 19th century inter-tribal fighting. Generally pa were stronger and more complex than Pakeha works which did not have to contend with artillery. The strategy was to invite attack from an enemy with considerable artillery and small-arms firepower. Hence the underground bunkers, multiple timber and earthwork lines of defence, and the protection afforded defenders at their firing positions close to the ground behind two stockade lines.

Taranaki pa for which we have contemporary plans include Onukukaitara with *ca* 2100 m<sup>2</sup> enclosed by defences (Fig. 21); Puketakauere, 585 m<sup>2</sup> (Fig. 20); Te Kohia, 350 m<sup>2</sup> (Fig. 16); Puketotara, 1000 m<sup>2</sup> (Fig. 27); Orongomaihangī, 1200 m<sup>2</sup> (Fig. 30) and Pukekakariki, 460 m<sup>2</sup> (Fig. 31). The defensive elements characteristic of pa may be seen in each of these drawings.

Garrison figures given by Grayling (1862:93) are claimed to derive from Maori sources: Puketakauere and Onukukaitara, 400; Huirangi (September 1860), 100; Kaihihi, 100; Mahoetahi, 150; Kairau and Matarikoriko, 800; Te Arei, 2000. Major Hutchins obtained a figure of 500 from Maori sources for the strongpoints and rifle pits at Waireka in August (War Office 0270.II:28–29). More than 1000 may have held the same positions in early 1861

(Grayling 1862:93). Governor Browne (GBPP 1861:17–19) gives the garrison at Te Kohia as about 70.

Some pa were stand-alone fortifications, including Te Kohia, Kaipopo and Mahoetahi. Others were grouped for support, such as Puketakauere and Onukukaitara, the Kaihihi River pa, and Kairau, Huirangi and other fortifications near Waitara. At Waireka in the winter of 1860 Maori works included three stockaded strongpoints in a network of rifle pits. Rifle pits were also employed with strongpoints at Kaihihi, the Huirangi and Te Arei bush edges in early 1861, and at Onukukaitara and Puketakauere.

An interesting group of Maori fortifications was on Greenwood's farm, Tataraimaka, where five pa were thrown up in winter 1860. There was also a strongpoint of rifle pits. This was a fortified line which barred the route south and held Pakeha land against its former owners. Earthworks thrown up by Waikato tribes in 1863–64 at Meremere, Rangiriri and Paterangi were similarly designed to prevent the advance of troops. The fortified lines at Huirangi and Te Arei consisted largely of rifle pits and were tactical works.

Rifle pits were used independently or in conjunction with pa in a flanking or surprise role, or they could be used independently. They comprised a hole in the ground, or traversed trench of varying length, partly covered by timber and earth as shown in Figure 52. An example of their effectiveness was at Puketakauere where advancing troops were caught unawares by defenders in rifle pits forward of the visible pa defences.

Pa were usually located at the forest edge: to channel the enemy's advance, and to allow

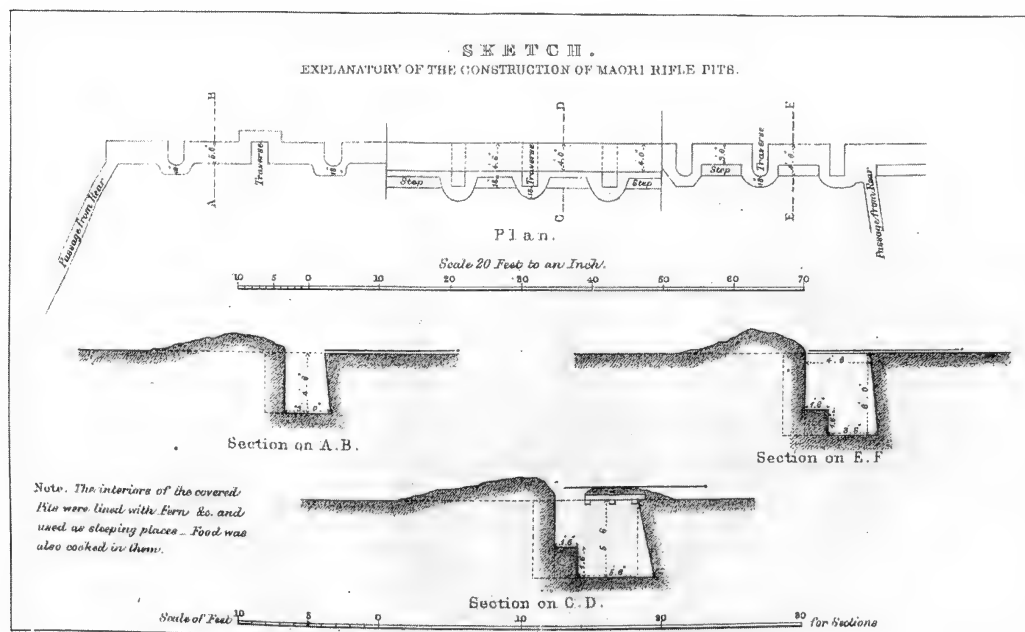


Fig. 52. 'Sketch. Explanatory of the construction of Maori rifle pits' (Pasley 1863).

an easy escape for the garrison if necessary. Nearby bush and gully rims gave positions for flanking fire. Maori were not bothered by having to abandon a pa, which was quickly carried out if circumstances required. They then built another pa elsewhere, to invite another attack by Pakeha forces.

Colonel Carey describes the Maori strategy.

“None of the positions taken up by the natives were of the slightest importance to them or to us. They did not cover magazines, roads, or any points of consequence; they were selected simply as spots the most inaccessible that could be found, from which retreat was secure. The abandonment of the paha after they had answered their purpose, was part of their system of war. In the native mind victory remained with the side that lost fewest men, and not with the possession of the barren piece of ground on which the fight took place. The Maori knew that when they assembled we had no choice but to attack them, and that we were only too glad when they took up a position. The mode of attack, however, was in our hands. Hitherto this had always been the same, viz. a rush on the place, which had at best resulted in its capture, with severe loss to us, and with little or none to the enemy.”

(Carey 1863:89–90)

Carey came to New Zealand as Deputy Adjutant General on Pratt’s staff and argues for the success of his chief’s tactic of sapping pa. He describes the Maori strategy well, but he exaggerates the willingness of British commanders to play the Maori game. When the enemy would not attack their fortified pa Maori strategic alternatives were limited.

In fact a feature of the war of 1860–61 is the considerable effort put into throwing up pa which were never attacked. These include the Te Atiawa pa Manutahi and Mataitawa, the Waireka fortifications, and the forest pa south of Stoney River described by Riemenschneider. Other pa found empty or quickly abandoned on the approach of troops show the difficulty faced by Maori in maintaining a fighting strength at several places while waiting for a Pakeha advance on one of them. This was not helped by Maori fighting men being heavily involved in food production at certain times of the year, a constraint not shared by the enemy.

## THE DEVELOPMENT OF STRATEGY

The New Zealand Wars of the 1860s are notable for the use of small fieldworks by both sides. This was rare in 19th century colonial warfare, and unusual in warfare anywhere. Maori had a long experience of fortified pa and used them in the campaigns as a key part of offensive and defensive strategies. Pakeha employed small fieldworks to protect lines of communication, at military and farming frontiers, and, less commonly – but importantly in the First Taranaki War – in tactical battlefield situations.

When British troops first took to the field in New Zealand they made little use of fortifications. Colonel Despard going so far as to order the removal of a breastwork at Waimate as an indication of weakness (Barthorp 1979:115). The First Taranaki War marks the adoption of fieldworks by British and colonial forces as a key element in waging war against the Maori.

At the same time, however, the 1860–61 campaign harks back to those of the 1840s in its lack on either side of a strategy that was likely to bring success, and in its failure to resolve

fundamental issues. The strategy of both sides was to inflict a defeat – or defeats – on the enemy, which would force them to back off the issue which led to war, in particular the Waitara purchase but also the general question of land sales to Europeans. Both sides suffered their greatest success and defeat at Maori pa – at Puketakauere and Mahoetahi.

But the war resolved nothing, and indeed could not since there was no mechanism by which either side could translate victory into resolution of the underlying conflict. That was to come later with the New Zealand Settlements Act which allowed the confiscation of Maori land, along with demographic and technological changes which closed down Maori options. Fortified pa were used to invite attack at the end of the sixties as they had been at the beginning; thus the limitations of Maori strategy were exposed. For the Pakeha the Taranaki war of 1860–61 was a learning experience. From 1863 the role of Pakeha fieldworks changed as European farmers took up confiscated land behind military frontiers. It was by this means that the issues left open in March 1861 were to be resolved.

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I must also thank the many landowners who have willingly given permission for me to walk over their properties, and who have mostly been interested in the work and forthcoming with useful observations they have made at the sites over the years. Taranaki people who have helped in my education regarding Maori values relating to historic sites include Hamiora Raumati and Te Rukoriri Wharehoka.

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AD100 Army Department, Militia Branch Inwards Letters.

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## APPENDIX 1. Archaeological site record and map references.

Site names are followed by NZMS 260 map sheet number, New Zealand Archaeological Association site record number if available, and map reference. Approximate map references are given where the location is known but archaeological evidence has not been found. Unlocated sites are not listed.

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### Pakeha fortifications north of New Plymouth:

Bell Block Stockade P19 086405  
 Camp Waitara Q19/90 166441  
 Mahoetahi Stockade (Ngapuketurua) Q19/118 140418  
 Matarikoriko Stockade Q19/122 175405  
 No 1 (Kairau) Redoubt Q19/142 169398  
 No 2 Redoubt Q19/143 171393  
 No 3 Redoubt Q19/144 174390  
 No 4 Redoubt Q19/145 *ca* 176388  
 No 5 Redoubt Q19/146 178386  
 No 6 (Huirangi) Redoubt Q19/147 179384  
 No 7 Redoubt Q19/148 188376  
 No 8 Redoubt Q19/149 190373  
 Puketakauere Stockade Q19/130 163423  
 Waitara Blockhouse Q19/45 163452

### New Plymouth bases and blockhouses:

Carrington Road Blockhouse P19/175 033372  
 Fort Cameron P19 *ca* 037375  
 Fort Herbert P19/174 035374  
 Fort Murray P19 *ca* 022378  
 Fort Niger P19/152 042380  
 Fort Stapp P19 *ca* 038388  
 Henui Blockhouse P19 *ca* 040385  
 Marsland Hill P19 029375  
 Mt Eliot P19 *ca* 027381  
 No 2 Blockhouse P19 *ca* 023372  
 No 3 Blockhouse P19/121 026370

### Pakeha fortifications south of New Plymouth:

Camp Parawaha P19 837275  
 Fort Strange P19 *ca* 870295)  
 Fort Turner P19/42 891298)  
 Omata Stockade P19/35 988350  
 Waireka Camp P19/36 970342

### Fortifications of Te Atiawa and allied tribes north of New Plymouth:

Huirangi Q19 *ca* 179384  
 Hurirapa Q19 *ca* 164451  
 Kairau Q19 *ca* 169398



Korihi Q19 *ca* 193410  
Mahoetahi Q19/114 135420  
Onukukaitara Q19/130 163423  
Puketakauere Q19/120 165424  
Puketotara P19/160 *ca* 060359  
Te Tutu Q19 *ca* 186371  
Te Arei Q19 *ca* 193369  
Te Kohia Q19 *ca* 156427

Taranaki and Ngati Ruanui fortifications:

Burton's Hill P19 *ca* 997318  
Kaipopo P19 972342  
Mahainui P20/26 821171  
Mataiaio P19/105 835266  
Orongomaihangī P19/40 835267  
Pukekakariki P19/205 837267  
Tarakihī P20/12 774185  
Waireka Hill fortifications P19 *ca* 965337  
Warea P20/92 770185

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# ANNOTATED CHECKLIST OF TYPE SPECIMENS OF NEW ZEALAND PLANTS IN THE AUCKLAND INSTITUTE AND MUSEUM HERBARIUM (AK). PART 5. DICOTYLEDONS

JULIET F. HERRICK AND EWEN K. CAMERON

*Abstract.* Type material of New Zealand dicotyledons in the AK Herbarium is presented in an annotated checklist of 590 taxa. This completes the five-part annotated checklist of vascular type specimens in the AK Herbarium.

The native dicotyledon collection in the herbarium of the Auckland Institute and Museum (AK) has been systematically searched for type specimens. The list of primary types by Cooper (1949) has been expanded, updated and annotated to include all possible types. This paper is a continuation of the series begun by Goulding (1978, 1980) and Wright (1978) and completes the checklists of type and presumptive type specimens for New Zealand vascular plants at AK.

Specimens thought to have type status are listed in alphabetical order within families, which are themselves arranged in alphabetical order. The names cited are as originally published, with a few orthographic corrections, and are followed by the author and publication reference. Where specific or sub-specific epithets of original names have not been retained at either taxonomic level in later nomenclatural synonyms (denoted using the  $\equiv$  symbol), the later names are entered separately and cross referenced to the original name. The type locality included in quotation marks is taken directly from the original description, the protologue. In citing the specimens, the type status is given first. This has been determined following the International Code of Botanical Nomenclature (Greuter *et al.* 1988). Some interpretation of the Code has been necessary and for our definitions refer to Appendix 1. Following the type status of each specimen is the locality, collector, date and AK number. Information from original labels has been used and where this is written in a hand other than that of the collector, an asterisk (\*) is placed at the beginning of the specimen data. Included in parentheses after the specimen data is the herbarium the specimen originated from, if not AK, and the former AK number of the specimen if renumbered. † after the specimen data refers to published designation of the specimen as type material. If the specimen is a secondary type, the herbarium holding the primary type is referenced. "Types" cited in Allan (1961) are accepted only as lectotypes where Allan has stated "lectotype" before the specimen number, as recommended by Brownsey (1979). Unless published as type material, all Colenso "types" annotated by Cheeseman, are treated with question marks (?) because of queries raised by Brownsey (1979).

Type specimens of six Cheeseman taxa appear to be missing (*Helichrysum selago* var. *acuta*, *H. selago* var. *tuberculata*, *Gaultheria rupestris* var. *lanceolata*, *Senecio myrianthos*,

*Helichrysum selago* var. *tumida* and *Pimelea aridula* var. *linearis*). For the latter two, Cheeseman cites only Cockayne material in the protologue - in the absence of these specimens at AK we suspect Cheeseman based his description solely on borrowed Cockayne material. Therefore these latter two taxa are not listed in the checklist. Also the Cheeseman specimens of *Dracophyllum adamsii* Petrie, part of the syntype listed by Petrie, cannot be located at AK. A single specimen of one of the taxa (*Pimelea lyallii* var. *sericea*), listed by Cooper (1949) as missing, has been located.

Author abbreviations follow Brummitt & Powell (1992), and abbreviations for herbaria follow Holmgren *et al.* (1990).

## CHECKLIST OF DICOTYLEDON TYPE AND PRESUMPTIVE TYPE SPECIMENS AT AK

### AIZOACEAE

***Tetragonia trigyna*** Banks et Sol. ex Hook.f., *Handbk. N.Z. Fl.*:84 (1864)

TYPE LOCALITY: "Northern Island: east coast, Banks and Solander. Sand-hills, Cape Turnagain, Colenso. Auckland, Sinclair."

Specimen: SYNTYPE, \* New Zealand, Banks and Solander, 1769-1770, AK 100182 (ex BM).

### ALSEUOSMIACEAE

***Alseuosmia pusilla*** Colenso, *Trans. Proc. N.Z. Inst.* 17:241 (1885)

TYPE LOCALITY: "In shady forests near Norsewood, County of Waipawa; 1884; W. C."

Specimens: ? ISOLECTOTYPES, \* Norsewood, Hawkes Bay, W. Colenso, no date, AK 9185, AK 106223-106224 (lectotype in WELT, †Gardner 1978:277).

***Alseuosmia turneri*** R.O. Gardner, *N.Z. J. Bot.* 16:271 (1978)

TYPE LOCALITY: "Ohakune, Mountain Road, Volcanic Plateau, Weinmannia-Podocarpus forest, c.680 m, R.O. Gardner 1161, 25 November 1975."

Specimens: ISOTYPE, Ohakune, Mountain Road, Volcanic Plateau, Weinmannia-Podocarpus forest, c.680 m, R.O. Gardner 1161, 25/11/1975, AK 141728 (ex AKU, †Gardner 1978:272); PARATYPE, \* Ohakune, (main trunk line), 2000 ft, E. Phillips Turner, no date, AK 36969 (ex Herb. E. Phillips Turner); PARATYPE, Ohakune, R. Cooper, 13.10.57, AK 50090 (holotype in CHR, †Gardner 1978:272).

### APIACEAE (UMBELLIFERAE)

***Aciphylla aurea*** W.R.B. Oliv., *Trans. R. Soc. N.Z.* 84:15 (1956)

TYPE LOCALITY: "... Swampy Hill, Otago, collected by W.R.B. Oliver ..."

Specimens: PARATYPES, St Arnaud Mountains, Nelson, 4500 ft, T.F.C., Jan 1878, AK 6391; \* Mt Stokes, Marlborough, E. Phillips Turner, no date, AK 105091 (ex Herb. E. Phillips Turner).

***Aciphylla cartilaginea*** Petrie, *Trans. Proc. N.Z. Inst.* 47:49 (1915)

TYPE LOCALITY: "Wet alpine meadow of the higher hills of Stewart Island; Mount

Rakiahua, P. Goyen! D. Petrie!; Frazer Peaks, F.R. Chapman! G.M. Thomson! D. Petrie.”  
Specimens: SYNTYPES, \* Summit of Mount Rakiahua, Stewart Island, 3500 ft, D. Petrie, no date, AK 6518, AK 210765 (formerly AK 6518.2).

*Aciphylla colensoi* Hook.f. var. *conspicua* Kirk, *Stud. Fl.*:207 (1899)

TYPE LOCALITY: “Ruahine Mountains, W.F. Howlett! Whangapeka, Nelson, Kingsley!”  
Specimen: SYNTYPE, \* Oroua River, Ruahine Range, W.F. Howlett, no date, AK 6394.

*Aciphylla congesta* Cheeseman, *Trans. Proc. N.Z. Inst.* 47:44 (1915)

TYPE LOCALITY: “South Island: Rocky places on the lower slopes of Mount Balloon, between Lake Te Anau and Milford Sound, alt. 3,500-4,500 ft; F.G. Gibbs!”

Specimens: SYNTYPES, \* Slopes of Mount Balloon, head of the Clinton Valley, F.R. Gibbs, Jan 1914, AK 6529-6532, AK 6535; \* Balloon Mt, McKinnon’s Pass, F.G. Gibbs, no date, AK 6528; \* slopes of Mt Balloon, McKinnon’s Pass, F.G. Gibbs, Jan 1914, AK 6534; \* Mount Balloon, SW Otago, 4000-5000 ft, F.G. Gibbs, Jan 1914, AK 6533.

*Aciphylla crosby-smithii* Petrie, *Trans. Proc. N.Z. Inst.* 47:48 (1915)

TYPE LOCALITY: “... collected by Mr J. Crosby Smith in January last, at an elevation of about 5,000 ft on Mount Cleughearn, Fiord County.”

Specimen: SYNTYPE, \* Mt Cleughearn, Fiord County, 4000 ft, J. Crosby Smith, 3rd Jan 1914, AK 6539 (ex Herb. D. Petrie).

*Aciphylla glaucescens* W.R.B. Oliv., *Trans. R. Soc. N.Z.* 84:13 (1956)

TYPE LOCALITY: “... Swampy Hill, Otago, collected by W.R.B. Oliver ...”

Specimens: PARATYPES, Mount Arthur, Nelson, T.F.C., Jan 1886, AK 6392; Wairau Valley, Nelson, alt 1700 ft, T.F.C., Jan 1881, AK 6393; \* Mount Owen, Nelson, 4000 ft, W. Townson, no date, AK 6411.

*Aciphylla hookeri* Kirk, *Stud. Fl.*:209 (1899)

TYPE LOCALITY: “South Island: Heaphy River, Nelson, J. Dall!”

Specimen: ?ISOLECTOTYPE, near the source of the Heaphy River, [? J. Dall], 20/7/94, AK 6433 (lectotype in WELT, † Le Comte and Webb 1981:189).

*Aciphylla horrida* W.R.B. Oliv., *Trans. R. Soc. N.Z.* 84:17 (1956)

TYPE LOCALITY: “... Alecs Knob, above Franz Joseph Glaciers, collected by W.R.B. Oliver ...”

Specimens: PARATYPES, \* Mount Kelvin, near Westport, alt 4500 ft, W. Townson, no date, AK 6397, AK 211969 (formerly AK 6397.2); source of Otekahe R, Westland, on western slopes of Walker’s Pass, L. Cockayne, Jan 1900, AK 6400 (ex Herb. L. Cockayne); \* source of Otekahe R, Westland, on western slopes of Walker’s Pass, L. Cockayne, Jan 1900, AK 211968 (formerly AK 6400.2, ex Herb. L. Cockayne); Arthur’s Pass, Canterbury, alt. 3000 ft, T.F.C., Jan 1881, AK 6401.

*Aciphylla indurata* Cheeseman, *Trans. Proc. N.Z. Inst.* 47:40 (1915)

TYPE LOCALITY: “South Island: Buller Valley - Mount Lyell and the Brunner Range, 3,000-5,000 ft; Paparoa Range, Mount Bovis, alt. 3,000-4,000 ft. W. Townson!”

Specimens: SYNTYPES, \* Mt Lyall, 3-4000 ft, W. Townson, no date, AK 6430-6431.

*Aciphylla kirkii* Buchanan, *Trans. Proc. N.Z. Inst.* 19:214 (1887)

TYPE LOCALITY: "... Mount Alta, in 1883."

Specimen: SYNTYPE, \* Mount Alta, Otago, 6000 ft, J. Buchanan, no date, AK 6541.

*Aciphylla monroi* Hook.f. var. *divisa* Cheeseman, *Trans. Proc. N.Z. Inst.* 47:42 (1914)

TYPE LOCALITY: "South Island: Mount Cook district, not uncommon in open grassy places, alt. 4,000-6,000 ft; T.F.C."

Specimens: SYNTYPES, Mt Olivier, Hooker Valley, Mt Cook, 5000 ft, T.F.C., Jan 1898, AK 6494-6496.

*Aciphylla multisecta* Cheeseman, *Trans. Proc. N.Z. Inst.* 47:43 (1915)

TYPE LOCALITY: "South Island: Rocky places on the lower slopes of Mount Balloon, between Lake Te Anau and Milford Sound, alt. 3,500-4,500 ft; F.G. Gibbs!"

Specimens: SYNTYPES, \* Mount Balloon, Clinton Valley, F.G. Gibbs, Jan 1914, AK 6500-6501.

*Aciphylla poppelwellii* Petrie, *Trans. Proc. N.Z. Inst.* 53:369 (1921)

TYPE LOCALITY: "... Garvie Mountains (Southland), 4000 ft: D. L. Poppelwell! Dr L. Cockayne!"

Specimens: SYNTYPE, \* Garvie Mountains, Otago, 4000 ft, D.L. Poppelwell, no date, AK 6525; ? SYNTYPE or ? ISOSYNTYPE, \* Garvie Mountains, Southland, D.L. Poppelwell, no date, AK 105090; PARATYPE, Kyeburn, Otago, 3000-4000 ft, D.P., Dec 1889, AK 6520 (ex Herb. D. Petrie).

*Aciphylla similis* Cheeseman, *Trans. Proc. N.Z. Inst.* 47:42 (1915)

TYPE LOCALITY: "South Island: Peaty bogs on Arthur's Pass, Canterbury Alps, alt. 3,000-4,000 ft; also near the Waimakariri Glacier; T.F.C. Upper Rakaia Valley; J.D. Enys!"

Specimens: LECTOTYPE, Arthur's Pass, Canterbury Alps, alt. 3000 ft, T.F.C., Jan 1883, AK 6468 († Dawson 1979:348); ISOLECTOTYPE, AK 6469.

*Aciphylla simplex* Petrie, *Trans. Proc. N.Z. Inst.* 22:440 (1890)

TYPE LOCALITY: "Mount Pisa, Mount Cardrona and Hector Mountains, 6,000 ft, on broken rock."

Specimen: SYNTYPE, Mt Cardrona, 6000 ft, D.P., Feb 1887, AK 6543 (ex Herb. D. Petrie).

*Aciphylla spedenii* Cheeseman, *Trans. Proc. N.Z. Inst.* 45:93 (1913)

TYPE LOCALITY: "South Island: Rocky places on Cecil Peak, near Lake Wakatipu, altitude 5,000-6,000 ft; also in several other localities on the Eyre Mountains of which Cecil peak is the northern termination; Mr James Speden!"

Specimens: SYNTYPES, \* Cecil Peak, near Lake Wakatipu, alt. 5500 ft, J. Speden, Jan 1912, AK 6536; \* Cecil Peak, near Lake Wakatipu, alt. 5500 ft, J. Speden, no date, AK 6537-6538.

*Aciphylla subflabellata* W.R.B. Oliv., *Trans. R. Soc. N.Z.* 84:12 (1956)

TYPE LOCALITY: "... Waiau, growing in tussock grassland, collected by W.R.B. Oliver ..."

Specimens: PARATYPES, Broken River, Canterbury Alps, alt 3000 ft, T.F.C., Jany 1883, AK 6412-6413; Broken River, Canterbury Alps, D.P., 8 Jany 1908, AK 6414; \* Broken River, Canterbury Alps, D.P., 8 Jany 1908, AK 209774 (formerly AK 6414.2).

*Aciphylla townsonii* Cheeseman, *Man. N.Z. Fl.*:1138 (1906)

TYPE LOCALITY: "South Island: Nelson-Mount Faraday, Mount Buckland and the Lyell Mountains, alt. 3000-4500 ft, W. Townson!"

Specimens: SYNTYPES, \* Mount Buckland, near Westport, W. Townson, no date, AK 6454-6456; \* Mount Faraday, 3-4000 ft, W. Townson, no date, AK 6459-6461; \* Mount Lyell, S. W. Nelson, 4000 ft, W. Townson, no date, AK 6462.

*Aciphylla trifoliolata* Petrie, *Trans. Proc. N.Z. Inst.* 48:186 (1916)

TYPE LOCALITY: "Rocky spurs on Mount Lyell, western Nelson ... Mr William Townson ..."

Specimens: ISOLECTOTYPES, \* Mount Lyell, Buller Valley, 4000 ft, W. Townson, no date, AK 6503-6504 (lectotype in WELT, † Dawson 1980:118).

*Aciphylla verticillata* W.R.B. Oliv., *Trans. R. Soc. N.Z.* 84:6 (1956)

TYPE LOCALITY: "Type from Mount Kyeburn in the Auckland Museum."

Specimen: SYNTYPE, \* Mount Kyeburn, Otago, 4000 ft, H.J. Matthews, no date, AK 6512.

*Azorella nitens* Petrie, *Trans. Proc. N.Z. Inst.* 25:270 (1893)

TYPE LOCALITY: "Shores of Lake Te Anau and banks of Clinton River (700-1,000 ft)."

Specimen: SYNTYPE, Lake Te Anau, no collector (label in Petrie's hand), Jan 1892, AK 6305 (ex Herb. D. Petrie).

*Hemiphues novae-zelandiae* Petrie, *Trans. Proc. N.Z. Inst.* 12:355 (1880)

TYPE LOCALITY: "Stewart Island."

Specimens: PARALECTOTYPE, Port Pegasus, Stewart Island, no collector (label in Thomson's hand), Jany 1880, AK 6354 (ex Herb. G.M. Thomson), (lectotype in WELT, † Webb 1980:344).

*Hydrocotyle hydrophila* Petrie, *Trans. Proc. N.Z. Inst.* 29:425 (1897)

TYPE LOCALITY: "Matata (Bay of Plenty); Otago Harbour; Wycliffe Bay; Tomahawk Lagoon; Bluff Harbour; Stewart Island."

Specimen: ? ISOLECTOTYPE, \* Wycliffe Bay, Otago, B.C. Aston, no date, AK 6239 (lectotype in WELT, † Webb and Johnson 1982:167).

*Hydrocotyle robusta* Kirk, *Stud. Fl.*:189 (1899)

TYPE LOCALITY: "North Island: on sandy beaches. Auckland: between Waiwera and Mahurangi. Great Barrier Island: Port Tryphena, Blind Bay, Haratoanga. Dec, Jan."

Specimen: SYNTYPE, Great Barrier Island, T.K., no date, AK 6269.

*Hydrocotyle sibthorpioides* Colenso, *Trans. Proc. N.Z. Inst.* 21:83 (1889)

TYPE LOCALITY: "Shaded woods near Dannevirke, County of Waipawa; 1887; W.C."

Specimens: ? SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 6283, AK 209491 (formerly AK 6283.2).

*Ligusticum acutifolium* Kirk, *J. Bot. Lond.* 29:237 (1891)

TYPE LOCALITY: "Snares Islands."

Specimen: SYNTYPE, \* Snares Islands, T. Kirk, 1890, AK 6562.

***Ligusticum aromaticum*** Hook.f. var. ***incisum*** Kirk, *Stud. Fl.*:204 (1899)

TYPE LOCALITY: "In limestone districts, Broken River, Canterbury, &c. Enys and Kirk."

Specimen: SYNTYPE, \* Limestone Rocks, Broken River, T. Kirk, no date, AK 6677.

***Ligusticum aromaticum*** Hook.f. var. ***lanuginosum*** Kirk, *Stud. Fl.*:204 (1899)

TYPE LOCALITY: "Mountains above Lake Tekapo, Cheeseman! Hector Mountains, Mount Pisa, Mount Cardona, &c., Otago, Petrie!"

Specimen: SYNTYPES or ISOSYNTYPES, mts above Lake Tekapo, Canterbury Alps, 5000 ft, T.F.C., Jan 1883, AK 6673; Hector Mountains, 5000 ft, Old Man Range, 4500 ft, D. Petrie, Feb 1886, AK 6676 (ex Herb. D. Petrie).

***Ligusticum capillifolium*** Cheeseman, *Trans. Proc. N.Z. Inst.* 47:45 (1915)

TYPE LOCALITY: "South Island: Mountains of south-west Otago, alt. 3,000-5,500 ft: mountains above Chalky Inlet, A. Reischek! Mount Tyndall, D. Petrie! Mount Bonpland, H.J. Matthews! slopes of Mount Balloon, McKinley's Pass, F.G. Gibbs! near Lake Harris, J. Speden!"

Specimens: SYNTYPES, \* slopes of Mount Balloon, 4500 ft, sw Otago, F.G. Gibbs, no date, AK 6592, AK 209490 (formerly AK 6592).

***Ligusticum deltoideum*** Cheeseman, *Trans. Proc. N.Z. Inst.* 14:299 (1882)

TYPE LOCALITY: "Grassy slopes on Mount Arthur, Nelson, alt. 4,000-5,500 ft."

Specimens: SYNTYPE, Mount Arthur, Nelson, alt. 4500 ft, T.F.C., Jan 1881, AK 6616; ? SYNTYPES, Mount Arthur, Nelson, alt. 4500 ft, T.F.C., no date, AK 6617; \* Mount Arthur, Nelson, T.F. Cheeseman, no date, AK 15210 (ex Herb. J. Adams).

***Ligusticum dissectum*** Kirk, *Stud. Fl.*:202 (1899)

TYPE LOCALITY: "North Island: Mount Holdsworth and other peaks of the Tararua Range, T.P. Arnold! Buchanan! 3,500 ft to 6,000 ft. Jan."

Specimen: SYNTYPE or ISOSYNTYPE, \* Tararua Mountains, J.P. Arnold, no date, AK 6604.

***Ligusticum diversifolium*** Cheeseman, *Man. N.Z. Fl.*:1139 (1906)

TYPE LOCALITY: "South Island: Nelson-shingle slopes on Mount Robert (overlooking Lake Rotoiti), alt. 4000 ft, F.G. Gibbs!"

Specimens: LECTOTYPE, \* Mount Robert, Lake Rotoiti, Nelson, 4000 ft, F.G. Gibbs, no date, AK 6628 (†Dawson 1967:406); ISOLECTOTYPES, AK 6627, AK 6629.

***Ligusticum enysii*** Kirk, *Trans. Proc. N.Z. Inst.* 9:548 (1877)

TYPE LOCALITY: "South Island: Limestone Rocks, Broken River, Canterbury. J.D. Enys and T. Kirk."

Specimen: ? SYNTYPE, \* Broken River Basin, Canterbury, 2500 ft, T. Kirk, no date, AK 6685.

***Ligusticum flabellatum*** Kirk, *Stud. Fl.*:205 (1899)

TYPE LOCALITY: "Stewart Island: in crevices of syenitic rocks near the South Cape. Jan."

Specimen: SYNTYPE, Stewart Island, South Cape, no collector (label in Kirk's hand), no date, AK 6686 (ex Herb. T. Kirk).



*Ligusticum latifolium* Hook.f. var. *angustatum* Kirk, *Stud. Fl.*:200 (1899)

TYPE LOCALITY: "Auckland and Campbell Islands. Dec, Jan."

Specimen: SYNTYPE, Campbell Island, no collector (label in Kirk's hand), no date, AK 6558 (ex Herb. T. Kirk).

*Ligusticum petraeum* Cheeseman, *Trans. Proc. N.Z. Inst.* 51:92 (1919)

TYPE LOCALITY: "South Island: abundant on the north face of Mount Owen, Nelson, alt. 4,000 ft; usually on the debris from limestone rocks; T.F.C. Also plentiful on the southern face of the same mountain; W. Townson! Broken River, Canterbury Alps, alt. 3,500 ft; T.F.C. Takitimu Mountains, Southland, alt. 3,500 ft, D. Petrie!"

Specimens: SYNTYPES, \* Mount Owen, Nelson, alt. 4500 ft, W. Townson, Jan 1882, AK 6639; Mount Owen, Nelson, 4500 ft, T.F.C., Jan 1882, AK 6640-6641; Broken River, Canterbury Alps, 3500 ft, T.F.C., no date, AK 6642; \* Takitimu Mountains, S.W. Otago, alt. 3500 ft, D. Petrie, Dec 1912, AK 6645.

*Ligusticum politum* Kirk, *Stud. Fl.*:202 (1899)

TYPE LOCALITY: "South Island: Ben Nevis, Mount Starveall, and Mount Lunar, Gibbs! Bryant!, Kingsley! Dec, Jan."

Specimens: \* SYNTYPES, Ben Nevis, Nelson, F.G. Gibbs, no date, AK 6492; \* Ben Nevis, F.G. Gibbs, Jan 1896, AK 6493.

*Oreomyrrhis ramosa* Hook.f., *Handbk. N.Z. Fl.*:91 (1864)

TYPE LOCALITY: "Middle Island - Otago, river flats in the lake district, Hector and Buchanan."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, Lake Wanaka District, 2,300 ft, no collector (label in Buchanan's hand), no date, AK 6371 (ex WELT).

*Pozoa exigua* Hook.f., *Handbk. N.Z. Fl.*:87 (1864)

TYPE LOCALITY: "Middle Island: Otago, lake district, alpine, Hector and Buchanan."

Specimens: ? SYNTYPES or ? ISOSYNTYPES, Black Peak, 7000 ft, no collector (label in Buchanan's hand), no date, AK 6328 (ex WELT); \* Black Peak, Otago, 7000 ft, J. Buchanan, no date, AK 6329.

*Pozoa microdonta* Colenso, *Trans. Proc. N.Z. Inst.* 23:387 (1891)

TYPE LOCALITY: "... wood south of Dannevirke, County of Waipawa; October 1889-90: W.C."

Specimen: ? SYNTYPE, \* near Dannevirke, Hawkes Bay, W. Colenso, no date, AK 6299.

*Schizeilema allanii* Cheeseman, *Man. N.Z. Fl.*:651 (1925)

TYPE LOCALITY: "North Island: Maharahara Mountain, southern end of Ruahine Mountains, near Woodville, alt. 4,000 ft. H.H. Allan."

Specimens: SYNTYPES, Summit Maharahara Pk, Ruahine Range, H.H. Allan, mid March 1923, AK 6309; \* Mount Maharahara, s. end of Ruahine Range, H.H. Allan, no date, AK 6310-6312.

*Schizeilema haastii* (Hook.f.) Domin subsp. *hookerianum* Domin, *Engl. Bot. Jb.* 40:583 (1908)

TYPE LOCALITY: "South Island; Canterbury leg. HAAST 1862 (n534, 675); Hunter river

on shingle, leg HAAST Sub n.51 (1000-1400); Mt Peal: Nelson leg. CHEESEMAM ...”  
Specimens: ISOSYNTYPES, Mount Peel, Nelson, alt. 5000 ft, T.F.C., Jan 1881, AK 6341-6342.

## APOCYNACEAE

*Parsonsia capsularis* (G. Forst.) R. Br. var. *grandiflora* Carse, *Trans. Proc. N.Z. Inst.* 49:46 (1917)

TYPE LOCALITY: “North Island. Great Barrier Island: Colonel Boscawen, per Mr Cheeseman! Whangarei district, Mangonui County: H.C. Usually in damp lowland situations.”

Specimens: SYNTYPES, \* Great Barrier Island, Col. Boscawen, no date, AK 7365; Flat Bush, Kaiaka-Kaitaia Road, H.C., Nov 1912, AK 7370 (ex Herb. H. Carse), AK 211645 (formerly AK 7370, ex Herb. H. Carse); roadside Kaiaka, H. Carse, Dec 1905, AK 7371 (ex Herb. H. Carse); Kaitaia, H.C., Jan 1912, AK 7372 (ex Herb. H. Carse).

*Parsonsia capsularis* (G. Forst.) R. Br. var. *parviflora* Carse, *Trans. Proc. N.Z. Inst.* 49:46 (1917)

TYPE LOCALITY: “In the North Island, ... it usually occurs in open hilly woods.”

Specimen: ? SYNTYPE, in hilly forest, Kaiaka, H.C., Dec 05, AK 7374.

*Parsonsia macrocarpa* Colenso, *Trans. Proc. N.Z. Inst.* 14:331 (1882)

TYPE LOCALITY: “Seventy-mile Bush, Hawke’s Bay; thickets near banks of streams, 1876-1881 ...”

Specimen: ? SYNTYPE, \* Seventy Miles Bush, Hawke’s Bay, W. Colenso, no date, AK 7347.

*Parsonsia ochracea* Colenso, *Trans. Proc. N.Z. Inst.* 22:480 (1890)

TYPE LOCALITY: “Edges of dry woods, south of Dannevirke, County of Waipawa; 1888: W.C.”

Specimen: ? SYNTYPE, Dannevirke, \* Hawkes Bay, W. Colenso, no date, AK 7358.

## ARALIACEAE

*Aralia crassifolia* Sol. ex A. Cunn., *Ann. Nat. Hist.* 2:214 (1839)

TYPE LOCALITY: “New Zealand (Northern Island) - 1769, Sir Jos. Banks. Shaded woods on the shores of the Bay of Islands, Wangaroa, &c. - 1826, A. Cunningham - 1833. R. Cunningham.”

Specimens: SYNTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 105146-105147 (ex BM), AK 184483 (ex BM).

*Aralia lyallii* Kirk, *Trans. Proc. N.Z. Inst.* 177:295 (1885)

TYPE LOCALITY: “South Island: Coal Island, Preservation Inlet (identified from the deck of a passing steamer); Stewart Island and outliers, chiefly on shady cliffs etc., Herekopere Island, Ruapuke Island, Green Island, Centre Island (nearly extinct).”

Specimens: SYNTYPE, Stewart Island, no collector (label in Kirk’s hand), no date, AK 6047 (ex Herb. T. Kirk); ? SYNTYPE, \* Herekopere Island, no collector, no date, AK 6048 (ex Herb. T. Kirk).

***Nothopanax macintyreii*** Cheeseman, *Man. N.Z. Fl.*:636 (1925)

TYPE LOCALITY: "South Island: ... a young tree cultivated in Dr Hunter's garden at Dunedin, and originally collected by the late Mr H.J. Matthews in some locality in the south of Westland."

Specimen: SYNTYPES, \* from a tree grown in Dr Hunter's garden at Dunedin, said to have come from Westland, W.E. Thomson, no date, AK 6089, AK 210199 (formerly AK 6089.2).

***Panax discolor*** Kirk, *Trans. Proc. N.Z. Inst.* 3:178 (1871)

TYPE LOCALITY: "From the sea-level to 2300 ft. Cape Colville Ranges, Great and Little Barrier Islands, Great Omaha, Whangaroa (North) T.K."

Specimen: SYNTYPE, Great Barrier Island, T.K., no date, AK 11484 (ex Herb. T. Kirk).

***Panax ferox*** Kirk, *Trans. Proc. N.Z. Inst.* 10:app. xxxiv (1878)

TYPE LOCALITY: "South Island - Near Nelson, Dr Hector and T. Kirk; Valley of the Buller, near the junction of the Matukituki; T.K., common near Dunedin, Mr Buchanan! (male flowers only)."

Specimens: SYNTYPES, Wairau Valley, Nelson, no collector (label in Kirk's hand), April 1873, AK 11489 (ex Herb. T. Kirk); near Nelson, T.K., April 1873, AK 11490 (ex Herb. T. Kirk), AK 11491 (ex Herb. T. Kirk).

***Panax gilliesii*** Kirk, *Stud. Fl.*:221 (1899)

TYPE LOCALITY: "North Island: Auckland District: Whangaroa North, inland, (1868), Gillies and Kirk."

Specimens: SYNTYPES, Whangaroa North, no collector (label in Kirk's hand), April 1868, AK 6161 (ex Herb. T. Kirk), AK 210198 (formerly AK 6161.2, ex Herb. T. Kirk).

***Panax lessonii*** DC. var. ***heterophylla*** Kirk, *Trans. Proc. N.Z. Inst.* 10:app. xxxv (1878)

TYPE LOCALITY: "North Island - Whangaroa (North)."

Specimens: SYNTYPES, Whangaroa North, no collector (label in Kirk's hand), April 1868, AK 6161 (ex Herb. T. Kirk), AK 210198 (formerly AK 6161.2, ex Herb. T. Kirk).

***Panax microphylla*** Colenso, *Trans. Proc. N.Z. Inst.* 16:328 (1884)

TYPE LOCALITY: "In shady open forests near Norsewood (S). Waipawa County, 1882-3: W.C."

Specimens: ? SYNTYPES, \* Norsewood, Hawkes Bay, W. Colenso, no date, AK 6082-6083.

#### ASTERACEAE (COMPOSITAE)

***Abrotanella caespitosa*** Petrie ex Kirk, *Trans. Proc. N.Z. Inst.* 24:420 (1892)

TYPE LOCALITY: "South Island: Otago, Mount Kyeburn, D. Petrie!"

Specimen: SYNTYPE, \* Otago, Mt Kyeburn, D. Petrie, Dec 1889, AK 10466.

***Abrotanella filiformis*** Petrie, *Trans. Proc. N.Z. Inst.* 47:51 (1915)

TYPE LOCALITY: "Wet peaty puddles in open lowland moor near the head of Paterson Inlet, Stewart Island."

Specimen: SYNTYPE, \* head of Paterson Inlet, Stewart Island, D. Petrie, no date, AK 10462.

*Abrotanella linearis* Bergg. var. *apiculata* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:170 (1943)

TYPE LOCALITY: "... at the sources of the Freeman River, near Fowler Pass, Lake Manapouri, altitude 1000-1200 m."

Specimen: SYNTYPE, \* Fowlers Pass, G. Simpson, no date, AK 22893.

*Abrotanella muscosa* Kirk, *Trans. Proc. N.Z. Inst.* 24:422 (1892)

TYPE LOCALITY: "Stewart Island: Summit of Rakiahua: 2,300 ft."

Specimen: SYNTYPE, summit of Mount Rakiahua, Stewart Island, T. Kirk, no date, AK 10473.

*Brachyglottis arborescens* W.R.B. Oliv., *Rec. Auck. Inst. Mus.* 3:236 (1948).

TYPE LOCALITY: "Type specimen in Auckland Museum collected by G.T.S. Baylis on Great Island, Three Kings Islands, December 1st, 1945."

Specimens: HOLOTYPE, \* Great Island, Three Kings Islands, G.T.S. Baylis, 1.12.1945, AK 22882; ISOTYPES, AK 22845-22848, AK 22880-22881, AK 218336 (formerly numbered 22881(A)).

*Brachyscome polita* Kirk, *Stud. Fl.*:261 (1899)

TYPE LOCALITY: "South Island: Arthur's Pass, T.K., 3000 ft. Dec."

Specimen: LECTOTYPE, \* Arthurs Pass, Canterbury, T. Kirk, no date, AK 9388 (†Davis 1949:100).

*Brachyscome radicata* Hook.f., *Fl. N.Z.* 1:127 (1853)

TYPE LOCALITY: "Northern Island, Cunningham, Colenso, Middle Island, Lyall."

Specimen: ISOSYNTYPE, \* Patea, Wellington Province, W. Colenso, no date, AK 9377.

*Brachyscome thomsonii* Kirk, *Trans. Proc. N.Z. Inst.* 16:372 (1884)

TYPE LOCALITY: "Stewart Island."

Specimen: LECTOTYPE and PARALECTOTYPES, Stewart's Island, T. Kirk, no date, AK 9380 (†Davis 1949:97).

*Brachyscome thomsonii* Kirk var. *dubia* Kirk, *Stud. Fl.*:261 (1899)

TYPE LOCALITY: "Otago: cliffs near Cape Whanbrow, T.K. Near Green Island, Petrie!"

Specimen: LECTOTYPE and PARALECTOTYPE, Oamaru, no collector (label in Kirk's hand), no date, AK 9389 (†Davis 1949:97).

*Brachyscome thomsonii* Kirk var. *membranifolia* Kirk, *Stud. Fl.*:261 (1899)

TYPE LOCALITY: "Mount Arthur Plateau, Cheeseman! Dunedin, Petrie!"

Specimens: LECTOTYPE and PARALECTOTYPES, Mt Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 9385 (†Davis 1949:97); PARALECTOTYPES, AK 9384, AK 106230.

*Cassinia amoena* Cheeseman, *Trans. Proc. N.Z. Inst.* 29:391 (1897)

TYPE LOCALITY: "Cliffs near the North Cape; abundant."

Specimens: SYNTYPES, North Cape, T.F.C., Jan 1898, AK 10298-10299.

*Cassinia vauvilliersii* (Hombr. et Jacquinot) Hook.f. var. *albida* Kirk, *Stud. Fl.*:315 (1899)  
 TYPE LOCALITY: "Kaikoura Mountains: not unfrequent, T.K. West Cape, Buchanan!"  
 Specimens: SYNTYPES, \* Kaikoura Mts, T. Kirk, no date, AK 10304; Kaikoura Mount, no collector (label in Kirk's hand), no date, AK 30904 (ex Herb. T. Kirk).

*Cassinia vauvilliersii* (Hombr. et Jacquinot) Hook.f. var. *serpentina* Cockayne et Allan, *Trans. Proc. N.Z. Inst.* 56:22 (1926)  
 TYPE LOCALITY: "South Island: Sounds-Nelson Botanical District - On mineral belt of the Dun Mountain: L.C."  
 Specimen: SYNTYPE, Mineral belt, Dun Mountain, L.C., Dec 1916, AK 31977 (ex Herb. L. Cockayne).

*Celmisia adamsii* Kirk, *Trans. Proc. N.Z. Inst.* 27:329 (1895)  
 TYPE LOCALITY: "North Island: Kaueranga Creek; T.K., Whakairi, 2000 ft; J. Adams and T.F. Cheeseman. Castle Rock, Coromandel; T.F. Cheeseman."  
 Specimens: SYNTYPES, Castle Rock, Coromandel, Dec 1884, T.F.C., no date, AK 9895; \* Table Mountain, J. Adams, Dec 1880, AK 9898; ? SYNTYPES, \* Table Mountain, Thames, J. Adams, no date, AK 9897, AK 15622 (ex Herb. J. Adams).

*Celmisia adamsii* Kirk var. *rugulosa* Cheeseman, *Man. N.Z. Fl.*:313 (1906)  
 TYPE LOCALITY: "Mount Manaia and hills to the north of Whangarei harbour, Kirk! T.F.C."  
 Specimens: SYNTYPES, Mt Manaia, Whangarei, T.F.C., Nov 1873, AK 9901-9902; ? SYNTYPE, Mt Manaia, no collector (label in Kirk's hand), no date, AK 11738.

*Celmisia argentea* Kirk, *Stud. Fl.*:292 (1899)  
 TYPE LOCALITY: "South Island: Maungatua, Southland, Petrie! Stewart Island: Mount Anglem; Rakiahua, Smith's Lookout, T.K. 500 ft to 3,300 ft. Dec, Jan."  
 Specimen: SYNTYPE or ISOSYNTYPE, Maungatua, 3000 ft, no collector (label in Petrie's hand), no date, AK 9970 (ex Herb. D. Petrie).

*Celmisia brevifolia* Cockayne ex Cheeseman, *Man. N.Z. Fl.*:938 (1925)  
 TYPE LOCALITY: "South Island; Canterbury - Mount Dobson Range, abundant. T.F.C.; Mount Earnest (head of Lake Wanaka), Cockayne; Mount Pisa, Petrie! Cockayne! Old Man Range, Cockayne, Two Thumb Range, A. Wall! 4500-6000 ft."  
 Specimens: SYNTYPES, \* Two Thumb Range, Otago, 6000 ft, Prof. Wall, April 1920, AK 9706; Mt Dobson, Lake Tekapo, 4000 ft, T.F.C., Jan 1883, AK 9707, AK 9710; Mt Dobson, Lake Tekapo, 5000 ft, T.F.C., Jan 1898, AK 9708-9709; Mt Ernest, about 5000 ft, L.C., 24 March 1921, AK 34925.

*Celmisia clavata* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:35 (1942)  
 TYPE LOCALITY: "... Table Hill, Stewart Island ..."  
 Specimen: SYNTYPE, \* peat bogs on mountains of Stewart Island, J.S.T. & G.S., no date, AK 32169.

*Celmisia compacta* Cheeseman, *Man. N.Z. Fl.*:955 (1925)  
 TYPE LOCALITY: "South Island: Nelson - summit of Mount Arthur, 6000 ft, T.F.C.,

Canterbury - crest of Mount Ollivier range, Mount Cook district, in rocky places, not common, 6500-7000 ft."

Specimens: SYNTYPES, summit of Mt Arthur, Nelson, 6000 ft, T.F.C., Jan 1881, AK 9960; crest of Mount Ollivier, Mt Cook District, 6500-7000 ft, T.F.C., Jan 1898, AK 9961.

*Celmisia cordatifolia* Buchanan, *Trans. Proc. N.Z. Inst.* 11:427 (1879)

TYPE LOCALITY: "Collected by Mr A McKay, January 1879, on Mount Starvation, Nelson!"

Specimen: SYNTYPE, \* Mt Starveall, Nelson, A. McKay, no date, AK 9792.

*Celmisia coriacea* Hook.f. var. *ensata* Kirk, *Stud. Fl.*:288 (1899)

TYPE LOCALITY: "Lake Harris, H. Matthews!"

Specimen: ISOLECTOTYPE, \* cultivated in Mr H.H. Matthews garden at Dunedin - original plant from Lake Harris, H.J. Matthews, no date, AK 9867 (lectotype in WELT, †Given 1980:138).

*Celmisia coriacea* Hook.f. var. *lancifolia* Cheeseman, *Man. N.Z. Fl.*:950 (1925)

TYPE LOCALITY: "Nelson - Mount Peel, abundant; mountains flanking the Wairau Valley, Clarence Valley, T.F.C.; Mount Lyell, W. Townson! Canterbury - Arthurs Pass, Cockayne! T.F.C."

Specimens: LECTOTYPE, Mount Peel, Nelson, alt. 4500 ft, T.F.C., Jan 1881, AK 9882 (†Given 1980:135); ISOLECTOTYPES, AK 9880-9881; PARALECTOTYPES, stony ground on old moraine, Arthur's Pass, 900 m, L. Cockayne, 28/xii/97, AK 9877; Raglan Range, Wairau Valley, alt. 4500 ft, T.F.C., Jan 1881, AK 9878; \* Mount Lyell, 3000-3500 ft, W. Townson, no date, AK 9879.

*Celmisia dubia* Cheeseman, *Man. N.Z. Fl.*:308 (1906)

TYPE LOCALITY: "South Island: Nelson - Mount Rochfort, Mount Frederic, and other localities near Westport, Townson! 2000-3000 ft. January-March."

Specimens: LECTOTYPE, \* Mount Rochfort, near Westport, W. Townson, no date, AK 9817 (†Given 1980:135); ISOLECTOTYPE, AK 34980 (ex Herb. H.B. Matthews); PARALECTOTYPES, Mt Frederick, near Westport, 2-3000 ft, T.F.C., no date, AK 9830; \* mountains near Westport, W. Townson, no date, AK 9831.

*Celmisia flaccida* Cockayne, *Trans. Proc. N.Z. Inst.* 31:422 (1899)

TYPE LOCALITY: "... Arthur's Pass, altitude 900 m; L.C.(1898) ..."

Specimen: ISOLECTOTYPE, stony ground on old moraine, Arthur's Pass, 900 m, L. Cockayne, 28/xii/97, AK 9877, (†Given 1980:139), (lectotype in K, †Given 1980:138).

*Celmisia gibbsii* Cheeseman, *Man. N.Z. Fl.*:300 (1906)

TYPE LOCALITY: "South Island: Nelson - Mount Cobb (to the north of Mount Arthur Plateau), F.G. Gibbs!"

Specimens: SYNTYPES, \* Mount Cobb, N.W. Nelson, F.G. Gibbs, no date, AK 9691-9692.

*Celmisia glabrescens* Petrie, *Trans. Proc. N.Z. Inst.* 47:50 (1915)

TYPE LOCALITY: "Meadow near Freshwater River, Stewart Island, 100 ft, D.L. Poppelwell!"

Specimen: SYNTYPE or ISOSYNTYPE, \* Freshwater River, Stewart Islands, D.L. Poppelwell, no date, AK 9983.

*Celmisia glandulosa* Hook.f. var. *latifolia* Cockayne, *Trans. Proc. N.Z. Inst.* 49:57 (1917)  
TYPE LOCALITY: "North Island: Egmont-Wanganui Botanical District - Mount Egmont ... L.C."

Specimen: SYNTYPE, Mt Egmont, L.C., Jan 17th 1905, AK 32152 (ex Herb. L. Cockayne).

*Celmisia graminifolia* Hook.f., *Fl. Antarct.* 1:35 (1844)

TYPE LOCALITY: "Hab. Bay of Islands. New Zealand."

Specimen: SYNTYPE, \* Bay of Islands, no collector, no date, AK 9926 (ex K).

*Celmisia haastii* Hook.f. var. *tomentosa* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:34 (1942)

TYPE LOCALITY: "Moist slopes near runnels on the Rock and Pillar Range, Otago, 1200-1500 m altitude."

Specimen: SYNTYPE, \* moist slopes near runnels on the Rock & Pillar Range, Otago, 1200-1500 m, G.S. & J.S.T., no date, AK 106430.

*Celmisia intermedia* Petrie, *Trans. Proc. N.Z. Inst.* 45:267 (1913)

TYPE LOCALITY: "Mount Frederic, 3,400 ft (P.G. Morgan)! Arthur's Pass, 3,000 ft, D.P.; mountains near Westport (Townson)! Mount Greenland, Westland (Dr L. Cockayne)!"

Specimens: ? SYNTYPES or ?ISOSYNTYPES, \* Mount Frederic, near Westport, W. Townson, no date, AK 9720; \* Mount Frederick, north of Westport, P.G. Morgan, no date, AK 9721; \* vicinity of Westport, W. Townson, no date, AK 9722.

*Celmisia lateralis* Buchanan var. *vilosa* Cheeseman, *Man. N.Z. Fl.*:302 (1906)

TYPE LOCALITY: "Mount Murchison, Buller Valley, Townson! 3000-4500 ft. December-January."

Specimens: SYNTYPES, \* Mount Murchison, Buller Valley, 3000 ft, W. Townson, no date, AK 24964, AK 209501 (formerly AK 24964), AK 209507 (formerly AK 24964).

*Celmisia longifolia* Cass. var. *alpina* Kirk, *Trans. Proc. N.Z. Inst.* 27:328 (1895)

TYPE LOCALITY: "South Island: In mountain-swamps, Mount Arthur, W.H. Bryant! Amuri, T.K. Canterbury, Arthur's Pass, &c., T.K."

Specimen: ? SYNTYPE, no locality, no collector (label in Kirk's hand), no date, AK 30916 (ex Herb. T. Kirk).

*Celmisia lyallii* Hook.f. var. *pseudolyallii* Cheeseman, *Man. N.Z. Fl.*:312 (1906)

TYPE LOCALITY: Not stated.

Specimen: ? SYNTYPE, Craigieburn Mountains, 1050 m, L. Cockayne, Jan 1896, AK 9845.

*Celmisia macmahonii* Kirk, *Trans. Proc. N.Z. Inst.* 27:327 (1895)

TYPE LOCALITY: "South Island: Mount Stokes, Marlborough, alt. 3000 ft, P.A. Macmahon!"

Specimens: SYNTYPES or ISOSYNTYPES, \* Mt Stokes, Marlborough, alt. 3800 ft, P. Macmahon, no date, AK 9963; Mt Stokes, Marlborough, J.H. Macmahon, no date, AK 9964; \* Mount Stokes, Marlborough, alt. 3800 ft, J.H. Macmahon, no date, AK 9965; Mount Stokes, Marlborough, Mt Richmond, Nelson, alt. 3800-4000 ft, Macmahon, no date, AK 132216.

*Celmisia major* Cheeseman, *Man. N.Z. Fl.*:952 (1925)

TYPE LOCALITY: "North Island: Auckland - Great Barrier Island, T. Kirk! Cliffs north of

the Manukau Harbour, T. Kirk, T.F.C., Taranaki - Mount Egmont Ranges, Buchanan, T.F.C. Sea-level to 4500 ft, December-February.”

Specimens: SYNTYPES, cliffs near the Manukau Heads, T.F.C., Dec 1882, AK 9903-9904; Mt Egmont, Taranaki, alt. 4000 ft, T.F.C., Jan 1886, AK 9905; Karekare Cliffs, north of Manukau Heads, T.F.C., Jan 1915, AK 9907-9908.

*Celmisia mollis* Cockayne, *Trans. N.Z. Inst.* 31:423 (1899)

TYPE LOCALITY: “Hill’s Peak, Canterbury, at an altitude of 1,200 m: L.C.(1898) ...”

Specimen: SYNTYPE, Hill’s Peak, 1200 m, L. Cockayne, 12/1/98, AK 9807 (ex Herb. L. Cockayne).

*Celmisia morganii* Cheeseman, *Trans. Proc. N.Z. Inst.* 46:21 (1914)

TYPE LOCALITY: “South Island; between Westport and the Ngakawau River, P.G. Morgan! near the mouth of the Ngakawau River, D. Petrie!”

Specimens: LECTOTYPE, \* vicinity of Westport, P.G. Morgan, no date, AK 9935 (†Given 1980:137); ISOLECTOTYPES, AK 9934, AK 9936; PARALECTOTYPES, near mouth of Ngakawau R, SW Nelson, D. Petrie, mid Feb 1913, AK 9933; \* Coalbrookdale near Westport, 2000 ft, P.G. Morgan, March 1912, AK 9937.

*Celmisia parva* Kirk, *Trans. Proc. N.Z. Inst.* 27:328 (1895)

TYPE LOCALITY: “South Island: Heaphy River. J. Dall!”

Specimen: ? SYNTYPE, \* Heaphy River, no collector, no date, AK 9967 (ex Herb. T. Kirk).

*Celmisia petiolata* Hook.f. var. *rigida* Kirk, *Stud. Fl.*:286 (1899)

TYPE LOCALITY: “Stewart Island, T.K.; descends to sea level.”

Specimen: SYNTYPE, Stewart Island, no collector (label in Kirk’s hand), 24/12/94, AK 9802.

*Celmisia petriei* Cheeseman, *Man. N.Z. Fl.*:311 (1906)

TYPE LOCALITY: “Otago - Clinton Saddle, Lake Te Anau, Petrie! Humboldt Mountains, H.J. Matthews!”

Specimens: SYNTYPES, \* Lake Harris, SW Otago, H.J. Matthews, no date, AK 9837; Clinton Saddle, 3000 ft, Te Anau, no collector, Jany 1892, AK 9838 (ex Herb. D. Petrie).

*Celmisia polyvena* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:34 (1942)

TYPE LOCALITY: “... Table Hill, Stewart Island ...”

Specimen: SYNTYPE, \* Table Hill, Stewart Is, Simpson and Thomson, no date, AK 32170.

*Celmisia prorepens* Petrie, *Trans. Proc. N.Z. Inst.* 19:326 (1887)

TYPE LOCALITY: “Old Man Range, 4,500 ft; Mt St Bathans, 5,000 ft.”

Specimen: SYNTYPE, \* Old Man Range, Otago, 4500 ft, D. Petrie, no date, AK 9762.

*Celmisia ramulosa* Hook.f. var. *tuberculata* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:34 (1942)

TYPE LOCALITY: “... Rough Peaks, Lake Wakatipu ...”

Specimen: SYNTYPE, \* Rough Peaks, Lake Wakatipu, G.S. & J.S.T., no date, AK 170505.



*Celmisia rupestris* Cheeseman, *Trans. Proc. N.Z. Inst.* 16:409 (1884)

TYPE LOCALITY: "Ravines on Mount Peel, Nelson, alt. 5000 ft."

Specimen: SYNTYPE, Mt Peel, Nelson, 5000 ft, T.F.C., January 1881, AK 9696.

*Celmisia rutlandii* Kirk, *Trans. Proc. N.Z. Inst.*, 27:329 (1895)

TYPE LOCALITY: "South Island: Mount Stokes, Marlborough, P.A. Macmahon!"

Specimen: ISOLECTOTYPE, \* Mount Stokes, Marlborough, J.H. Macmahon, no date, AK 9803 (lectotype in WELT, †Given 1980:137).

*Celmisia semicordata* Petrie, *Trans. Proc. N.Z. Inst.* 46:33 (1914)

TYPE LOCALITY: "Buckland Peaks (near Westport), 3,300-4,000 ft; Charleston, 30-40 ft."

Specimens: PARALECTOTYPES, \* Charleston, on rocks near the sea, D. Petrie, Feb 1913, AK 9870-9871 (lectotype in WELT, †Given 1980:133).

*Celmisia sessiflora* Hook.f. var. *minor* Petrie, *Trans. Proc. N.Z. Inst.* 15:359 (1883)

TYPE LOCALITY: "Swampy ground on the summit of Maungatua, Taieri, 2,900 feet."

Specimen: SYNTYPE, Maungatua, 3000 ft, no collector (label in Petrie's hand), no date, AK 9970 (ex Herb. D. Petrie).

*Celmisia thomsonii* Cheeseman, *Trans. Proc. N.Z. Inst.* 48:211 (1916)

TYPE LOCALITY: "South Island: Eyre Mountains, Central Otago, in rock-crevices on the faces of cliffs, alt. 5,000-6,000 ft, W.A. Thomson and J. Speden!"

Specimen: SYNTYPE, \* Eyre Mountains, Otago, 5000-6000 ft, W.A. Thomson & J. Speden, no date, AK 9976.

*Celmisia vespertina* Given, *N.Z. J. Bot.* 7:389 (1969)

TYPE LOCALITY: "Tops east of Mount Fox, Westland National Park, P. Wardle & I.R. Fryer."

Specimens: PARATYPES, \* Griffin Range, Westland, alt. 4000 ft, P.G. Morgan, no date, AK 9912 (†Given 1969:392); Fritz Range, 5,000 ft, Franz Joseph, Peter Hutton, 10.1.66, AK 109013 (†Given 1969:392); \* Hectors Col, 5000 ft, Mt Aspiring, Peter Hutton, 2.1.66, AK 109014 (†Given 1969:392), (holotype in CHR, †Given 1969:389).

*Celmisia viscosa* Hook.f., *Handbk. N.Z. Fl.*:133 (1864)

TYPE LOCALITY: "Middle Island: summit of Mount Torlesse, alt. 5-6000 ft, Haast; Otago, lake district, subalpine, Sinclair & Haast."

Specimen: ? SYNTYPE, \* no locality, no collector, no date, AK 9850 (ex K).

*Cotula albida* ≡ *C. pectinata* var. *sericea*

*Cotula calcarea* D.G. Lloyd, *N.Z. J. Bot.* 10:334 (1972)

TYPE LOCALITY: "Sand dunes and exposed conglomerate rock slopes, Wharariki Beach, N. of Westhaven Inlet, Nelson, 10 Dec 1967, D.G. Lloyd 67736, CANU 17227."

Specimen: ISOTYPE, Wharariki Beach, N. of Westhaven Inlet, Nelson, sand dunes and exposed conglomerate rock slopes, D.G. Lloyd, 10.12.1967, AK 132308 (ex CANU) (holotype in CANU, †Lloyd 1972:334).

***Cotula dendyi*** Cockayne, *Trans. Proc. N.Z. Inst.* 47:118 (1915)

TYPE LOCALITY: "South Island: common on subalpine and alpine shingle-slips of the drier mountains where there is a steppe climate."

Specimen: PARALECTOTYPE, shingle slip, Craigieburn Mountains, 1000 m, L. Cockayne, Jan 1896, AK 10356 (ex Herb. L. Cockayne), (lectotype in WELT, †Lloyd 1972:346).

***Cotula dioica*** Hook.f. var. ***rotundata*** Cheeseman, *Man. N.Z. Fl.*:359 (1906)

TYPE LOCALITY: "Cliffs between the Manukau and Kaipara Harbours, T.F.C.; East Coast, Colenso!"

Specimens: LECTOTYPE, cliffs, Waitakare (sic) West, T.F.C., Dec 1880, AK 10445 (†Lloyd 1972:316); PARALECTOTYPE, \* East Coast, W. Colenso, no date, AK 10446.

***Cotula dispersa*** D.G. Lloyd subsp. ***rupestris*** D.G. Lloyd, *N.Z. J. Bot.* 10:313 (1972).

TYPE LOCALITY: "Wet calcareous sandstone coastal cliffs, Castlecliff, Wanganui, A. Esler, April 1969, CANU 15541!"

Specimen: ISOTYPE, Castlecliff, Wanganui, wet calcareous sandstone cliffs, A.E. Esler, Ap[ril] 1969, AK 217810 (holotype in CANU, †Lloyd 1972:313).

***Cotula goyenii*** Petrie, *Trans. Proc. N.Z. Inst.* 18:295 (1886)

TYPE LOCALITY: "Old Man Range, 5,000 ft; and Mount Pisa, 5,000 to 6,000 ft."

Specimen: ? ISOLECTOTYPE, Mt Pisa, Otago, alt. 6000 ft, T.F.C., no date, AK 10391 (lectotype in WELT, †Lloyd 1972:352).

***Cotula linearifolia*** Cheeseman, *Trans. Proc. N.Z. Inst.* 15:299 (1883)

TYPE LOCALITY: "Mountains flanking the Wairau Valley, Nelson, alt. 3,000-4,500 feet."

Specimens: LECTOTYPE, Red Hills, Wairau Valley, alt. 4500 ft, T.F.C., Jan 1882, AK 128753 (†Lloyd 1972:362); ISOLECTOTYPE, AK 128752.

***Cotula obscura*** Kirk, *Stud. Fl.*:327 (1899)

TYPE LOCALITY: "South Island: in swamps at Woodend, Southland, T.K., Nov (1887)."

Specimen: SYNTYPE, Woodend, Southland, Kirk, no date, AK 10433.

***Cotula pectinata*** Hook.f. var. ***sericea*** Kirk, *Stud. Fl.*:326 (1899) ≡ ***C. albida*** D.G. Lloyd, *N.Z. J. Bot.* 10:353 (1972)

TYPE LOCALITY: "Mount Cardrona and Old Man Range, 4,000 to 5,000 ft, Petrie!"

Specimens: ISOLECTOTYPE, Old Man Range and Mt Cardrona, Otago, 4-5000 ft, D. Petrie, no date, AK 10388 (ex Herb. D. Petrie); ISOLECTOTYPE, \* Old Man Range and Mt Cardrona, Otago, 4-5000 ft, D. Petrie, no date, AK 212127 (formerly AK 10388.2), (lectotype in CHR, †Lloyd 1972:353).

***Cotula pulchella*** Kirk, *Stud. Fl.*:328 (1899)

TYPE LOCALITY: "South Island: in boggy ground near Lincoln, Canterbury. Invercargill: mouth of the Oreti River; the Bluff Hill. Stewart Island: rare and local, T.K."

Specimen: SYNTYPE, south side of Paterson's Inlet, Stewart Island, T. Kirk, no date, AK 10434.

***Cotula traillii*** Kirk, *Stud. Fl.*:324 (1899)

TYPE LOCALITY: "Stewart Island: often on blown sand. T.K. Dec-Feb."

Specimen: ISOLECTOTYPE, \* Stewart Island, Kirk, no date, AK 10372 (lectotype in WELT, †Lloyd 1972:323).

***Cotula willcoxii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 48:212 (1916)

TYPE LOCALITY: "South Island: Head of Lake Wakatipu, Otago, near Mount Earnslaw, W. Wilcox!"

Specimens: LECTOTYPE, \* near Mount Earnslaw, Otago, W. Wilcox, no date, AK 24966 (†Lloyd and Webb 1987:103); ISOLECTOTYPE, AK 209500.

***Eurybia nummularifolia*** Hook.f., *Fl. N.Z.* 1:118 (1853)

TYPE LOCALITY: "Northern and Middle Islands. Tongariro and mountains above Nelson, altitude 4500 feet. Bidwill. East Coast, Mount Hikurangi, etc, Colenso."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, \* no locality, W. Colenso, no date, AK 9577.

***Gnaphalium collinum*** Labill. var. ***obscurum*** Kirk, *Stud. Fl.*:300 (1899) ≡ ***G. ensifer*** D.G. Drury, *N.Z. J. Bot.* 10:151 (1972)

TYPE LOCALITY: "Broken River basin, 2,000 ft to 3,000 ft, T.K."

Specimen: ISOLECTOTYPE, Broken River, Canterbury, Kirk, no date, AK 10075 (†Drury 1972:152), (lectotype in WELT, †Drury 1972:152).

***Gnaphalium ensifer*** ≡ ***G. collinum*** var. ***obscurum***

***Gnaphalium luteo-album*** L. var. ***compactum*** Kirk, *Stud. Fl.*:298 (1899)

TYPE LOCALITY: "Lake Lyndon, Enys and Kirk."

Specimens: ? SYNTYPES, \* Lake Lyndon, Canterbury, T. Kirk, no date, AK 10056; Lake Lyndon, no collector (label in Kirk's hand), no date, AK 30914 (ex Herb. T. Kirk, ex MO).

***Gnaphalium paludosum*** Petrie var. ***polylepis*** D.G. Drury, *N.Z. J. Bot.* 10:155 (1972)

TYPE LOCALITY: "T. Kirk, Trelissick [Broken River] Basin, Feb 1881."

Specimen: ISOLECTOTYPE, Broken River, Canterbury, Kirk, no date, AK 10076 (†Drury 1972:155), (lectotype in WELT, †Drury 1972:155).

***Haastia recurva*** Hook.f. var. ***wallii*** Cockayne, *Trans. Proc. N.Z. Inst.* 50:175 (1918)

TYPE LOCALITY: "... collected by Professor A. Wall on a shingle slip near the summit of Mount Fyffe, Seaward Kaikoura Mountains ... Shingly Range (Awatere) ..."

Specimen: SYNTYPE, shingle slip near the summit of Mount Fyffe, Kaikoura Mountains, L.C., no date, AK 32195 (ex Herb. L. Cockayne).

***Helichrysum dimorphum*** Cockayne, *Trans. Proc. N.Z. Inst.* 47:117 (1915)

TYPE LOCALITY: "South Island: Canterbury - climbing through and over river-terrace scrub on the banks of the River Poulter, near the Mount White Bridge, and at Puffer's Creek, Waimakariri River basin. L.C."

Specimens: SYNTYPE, climbing amongst and over tall river scrub. R. Poulter near bridge, L. Cockayne, Jan 1900, AK 10250 (ex Herb. L. Cockayne); ? SYNTYPE, \* Poulter River, Waimakariri Basin, Dr Cockayne, no date, AK 10251.

*Helichrysum (Leucogenes) grahamii* Petrie, *Trans. Proc. N.Z. Inst.* 45:268 (1913)

TYPE LOCALITY: "In clefts of rock on Sebastopol Ridge, Sealey Range, Hooker Valley, Mount Cook."

Specimen: SYNTYPE or ISOSYNTYPE, \* Mount Sebastopol, P. Graham, no date, AK 10209.

*Helichrysum pauciflorum* Kirk, *Trans. Proc. N.Z. Inst.* 27:351 (1895)

TYPE LOCALITY: "South Island: Craigieburn Mountains, L. Cockayne."

Specimen: SYNTYPE or ISOSYNTYPE, Craigieburn Mts, growing on solid rock, 1500 m, L. Cockayne, 13/iii/91, AK 10245 (ex Herb. L. Cockayne).

*Helichrysum plumeum*  $\equiv$  *H. selago* var. *tomentosum*

*Helichrysum prostratum* Hook.f., *Fl. Antarctica* 1:30 (1844)

TYPE LOCALITY: "Lord Auckland's group and Campbell's Island ... Mount Egmont, in the Northern Island of New Zealand, at an altitude of 4000 ft, by Dr Dieffenbach."

Specimen: SYNTYPE, \* Campbell Island, J.D. Hooker, no date, AK 143166 (ex BM).

*Helichrysum purdiei* Petrie, *Trans. Proc. N.Z. Inst.* 22:440 (1890)

TYPE LOCALITY: "Dunedin, at Vauxhall and Black Jack's point ... Mr A.C. Purdie."

Specimen: SYNTYPE, \* Dunedin, A.C. Purdie, Dec 1889, AK 10227 (ex Herb. D. Petrie) (Fig. 1).

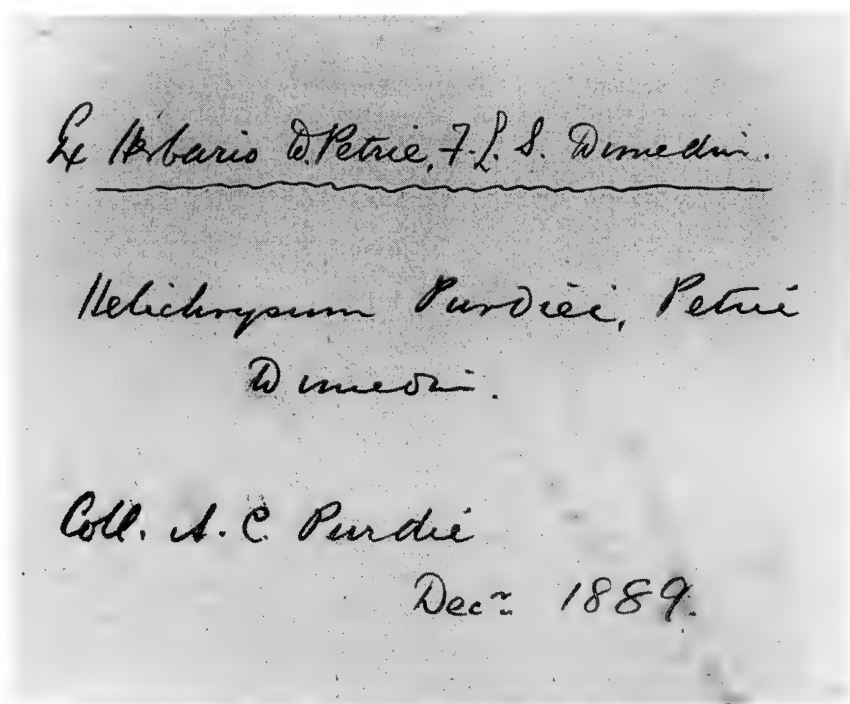


Fig. 1. Herbarium label of D. Petrie, 1889 (AK 10227), syntype of *Helichrysum purdiei* (10 x 8 cm).

***Helichrysum selago*** Benth. et Hook.f. var. ***acuta*** Cheeseman, *Man. N.Z. Fl.*:985 (1925)

TYPE LOCALITY: "Mountains behind the Hanmer Plains, T.F.C., C.E. Christensen!"

Specimen(s): Not located, also reported as missing by Cooper (1949). No potential Cheeseman neotypes identified.

***Helichrysum selago*** Benth. et Hook.f. var. ***tomentosum*** Cheeseman, *Man. N.Z. Fl.*:343 (1906) = ***H. plumeum*** Allan, *Trans. R. Soc. N.Z.* 76:594 (1947)

TYPE LOCALITY: "Mount Dobson, T.F.C., 2000-4500 ft. December-January."

Specimens: SYNTYPES, Mt Dobson, Canterbury Alps, 4000 ft, T.F.C., Jan 1883, AK 24965, AK 209498-209499 (formerly AK 24965).

***Helichrysum selago*** Benth. et Hook.f. var. ***tuberculata*** Cheeseman, *Man. N.Z. Fl.*:985 (1925)

TYPE LOCALITY: "Wairau Gorge, Nelson, alt. 3000 ft, T.F.C., Cockayne!"

Specimen(s): Not located, also reported as missing by Cooper (1949). No potential Cheeseman neotypes identified.

***Lagenifera cuneata*** Petrie, *Trans. Proc. N.Z. Inst.* 51:106 (1919)

TYPE LOCALITY: "Eweburn and Sowburn Creeks, Maniototo County; Cromwell; Flagstaff Hill, Dunedin; Macrae's, Waihero County; Tasman Valley; Takitimu Mountains: D.P."

Specimens: ISOLECTOTYPE, Flagstaff Hill, Dunedin, D. Petrie, 12.1.1908, AK 9346; PARALECTOTYPES, \* Takitimu Mountains, D. Petrie, no date, AK 9345, AK 211965 (formerly AK 9345), (lectotype in WELT, †Drury 1974:384).

***Lagenifera linearis*** Petrie, *Trans. Proc. N.Z. Inst.* 25:271 (1893)

TYPE LOCALITY: "Grassy flats on the shores of Lake Te Anau."

Specimens: LECTOTYPE and PARALECTOTYPES, Lake Te Anau, no collector (label in Petrie's hand), no date, AK 9361 (ex Herb. D. Petrie, †Davis 1949:103).

***Lagenifera pinnatifida*** Hook.f. var. ***hirsutissima*** Cockayne, *Trans. Proc. N.Z. Inst.* 48:197 (1916)

TYPE LOCALITY: "North Island: Hawke's Bay - Upper part of Wairoa River; T. Kirk! South Island: Fairly common in eastern *Nothofagus* forest, especially of montane belt from Nelson to Otago, Cheeseman, L.C. and others."

Specimen: SYNTYPE, *Nothofagus* forest near Springfield, Canterbury, L. Cockayne, March 1901, AK 35069 (ex Herb. L. Cockayne).

***Lagenifera pinnatifida*** Hook.f. var. ***tenuifolia*** Cockayne, *Trans. Proc. N.Z. Inst.* 48:197 (1916)

TYPE LOCALITY: "North Island: Auckland - Tauroa, Mongonui County: H. Carse! L.C."

Specimens: PARALECTOTYPES, woods among sandhills, Tauroa, Reef Pt, H.C., Jan 1908, AK 9352; \* near Reef Point, Auckland, H. Carse, Jan 1908, AK 35068 (ex Herb. L. Cockayne), (lectotype in WELT, †Drury 1974:384).

***Lagenifera purpurea*** Kirk, *Stud. Fl.*:257 (1899)

TYPE LOCALITY: "South Island: Catlin's River, T.K."

Specimens: SYNTYPES, \* Catlins River, Otago, T. Kirk, no date, AK 9350; Catlins River, no collector (label in Kirk's hand), no date, AK 30646 (ex Herb. T. Kirk, ex MO).

***Olearia allomii*** Kirk, *Trans. Proc. N.Z. Inst.* 3:179 (1871)

TYPE LOCALITY: "In rather open places on the Great Barrier Island; frequent from 800 to 2300 ft."

Specimen: SYNTYPE, Great Barrier Island, T.K., Nov 1867, AK 9475.

*Olearia buchananii* Kirk, *Stud. Fl.*:267 (1899)

TYPE LOCALITY: "North Island: probably Taranaki or Auckland; the exact locality uncertain. Buchanan! 1870."

Specimen: ? ISOTYPE, \* North Island, J. Buchanan, 1870, AK 9456 (holotype in WELT, †Kirk 1899:267).

*Olearia bullata* ≡ *O. virgata* var. *rugosa*

*Olearia chathamica* Kirk, *Trans. Proc. N.Z. Inst.* 23:444 (1891)

TYPE LOCALITY: "Chatham Islands, H.H. Travers!"

Specimen: ? SYNTYPE, \* Chatham Islands, no collector (label in Kirk's hand), no date, AK 9426 (ex Herb. T. Kirk).

*Olearia cheesemanii* ≡ *O. nitida* var. *angustifolia*

*Olearia colorata* Colenso, *Trans. Proc. N.Z. Inst.* 12:363 (1879)

TYPE LOCALITY: "Dry forests, Forty-mile Bush, head of the River Manawatu; 1876-1878."

Specimen: ? SYNTYPE, \* Hawkes Bay, W. Colenso, no date, AK 9521.

*Olearia coriacea* Kirk, *Stud. Fl.*:276 (1899)

TYPE LOCALITY: "South Island: Marlborough: Awatere and Mount Fyffe, T.K."

Specimen: SYNTYPE, \* Mount Fyffe, T. Kirk, no date, AK 9624.

*Olearia cunninghamii* Hook.f. var. *miniata* Kirk, *Stud. Fl.*:270 (1899)

TYPE LOCALITY: "North Island: from the North Cape to Cook Strait. South Island: Marlborough and Nelson. Sea-level to 2,800 ft. Reported from the west coast of Otago, doubtless in error. Nov."

Specimen: SYNTYPE, \* Cemetery Gully, Auckland, T. Kirk, no date, AK 9529.

*Olearia fragrantissima* Petrie, *Trans. Proc. N.Z. Inst.* 23:398 (1891)

TYPE LOCALITY: "Otepopo; Dunedin (Vauxhall and Saddle Hill); Tairoa Head; Catlin's River."

Specimen: ? SYNTYPE, no locality, D. Petrie, no date, AK 9627.

*Olearia insignis* Hook.f. var. *minor* Cheeseman, *Trans. Proc. N.Z. Inst.* 48:211 (1916)

TYPE LOCALITY: "South Island: Marlborough, between Kaikoura and Blenheim, H.J. Matthews!"

Specimen: SYNTYPE, \* on road to Blenheim from Christchurch, H.J. Matthews, no date, AK 9390.

*Olearia laxiflora* Kirk, *Stud. Fl.*:275 (1899)

TYPE LOCALITY: "South Island: Hokitika, H. Tipler!"

Specimen: ? SYNTYPE or ? ISOSYNTYPE, \* Hokitika, H. Tipler, no date, AK 9638.

*Olearia moschata* Hook.f., *Handbk. N.Z. Fl.*:127 (1864)

TYPE LOCALITY: "Middle Island: Mount Cook, 2500-3500 ft, and banks of Haast and Hopkins rivers, Haast; Otago, lake district, alt. 2000 ft, Hector and Buchanan."

Specimens: ? SYNTYPE, \* no locality, no collector, no date, AK 9552 (ex K); ? SYNTYPE or ? ISOSYNTYPE, \* Lake Ohau, Canterbury Alps, J. Buchanan, no date, AK 9556.

*Olearia nitida* Hook.f. var. *angustifolia* Cheeseman, *Man. N.Z. Fl.*:285 (1906)  $\equiv$  *O. cheesemanii* Cockayne et Allan, *Trans. Proc. N.Z. Inst.* 57:57 (1926)

TYPE LOCALITY: "Ohinemuri Gorge, Thames Valley, T.F.C., Petrie!"

Specimens: SYNTYPES, Ohinemuri Gorge, T.F.C., July 1897, AK 9498-9500.

*Olearia nitida* Hook.f. var. *cordatifolia* Kirk, *Stud. Fl.*:268 (1899)

TYPE LOCALITY: "Stewart Island, Kirk."

Specimen: SYNTYPE, \* Stewart Island, T. Kirk, no date, AK 9496.

*Olearia oleifolia* Kirk, *Trans. Proc. N.Z. Inst.* 11:463 (1879)

TYPE LOCALITY: "South Island; Ashburton, T.H. Potts! Rangitata, 4,000-5,000 ft, J.F. Armstrong! Preservation Inlet, Otago, J.D. Enys!"

Specimen: SYNTYPE or ISOSYNTYPE, \* Rangitata Valley, Southern Alps, 4-5000 ft, J.F.A., no date, AK 9565.

*Olearia oporina* (G. Forst.) Hook.f. var. *robusta* Kirk, *Stud. Fl.*:265 (1899)

TYPE LOCALITY: "South Island: Martin's Bay to Preservation Inlet."

Specimen: ? SYNTYPE, Puysegur Point, no collector (label in Kirk's hand), no date, AK 9431 (ex Herb. T. Kirk).

*Olearia pachyphylla* Cheeseman, *Trans. Proc. N.Z. Inst.* 42:216 (1910)

TYPE LOCALITY: "North Island: Bay of Plenty, hills at Opape, on road from Opotiki to Torere and Te Kaha; Bishop Williams!"

Specimens: SYNTYPES, \* Opape, between Opotiki & Torere, Bishop Williams, March 1907, AK 9480-9482.

*Olearia ramuliflora* Colenso, *Trans. Proc. N.Z. Inst.* 22:467 (1890)

TYPE LOCALITY: "Sides of streamlets, open ground, south of Dannevirke, County of Waipawa; 1887-88: W.C."

Specimens: ? SYNTYPES, \* no locality, W. Colenso, no date, AK 9641-9642, AK 210590 (formerly AK 9641.2).

*Olearia suavis* Cheeseman, *Trans. Proc. N.Z. Inst.* 24:409 (1892)

TYPE LOCALITY: "Hab. Mount Arthur plateau, Nelson, alt. 4000 ft."

Specimens: SYNTYPES, Mt Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 9535-9537.

*Olearia thomsonii* Cheeseman, *Man. N.Z. Fl.*:918 (1925)

TYPE LOCALITY: "North Island: Wanganui River, Ohura Basin, B.C. Aston! W.A. Thomson! (cultivated specimens)."

Specimens: SYNTYPES, \* Ohura River, near junction with Wanganui, B.C. Aston, no date, AK 9485-9488; \* Ohura Basin, Wanganui River, B.C. Aston, March 1920, AK 9489; \*

cultivated in Dunedin, A.W. Thomson, no date, AK 9490; ? SYNTYPE, no locality, W.E. Thomson, no date, AK 9491.

***Olearia townsonii*** Cheeseman, *Man. N.Z. Fl.*:917 (1925)

TYPE LOCALITY: "North Island: Upper Kaueranga Valley, Thames, W. Townson! December-January."

Specimens: SYNTYPES, \* Thames, Kaueranga Valley, W. Townson, no date, AK 9476; \* Upper Kaueranga Valley, Thames, W. Townson, Nov 1919, AK 9477; \* Upper Kaueranga Valley, Thames, W. Townson, Jan 1920, AK 9478-9479.

***Olearia traillii*** Kirk, *Trans. Proc. N.Z. Inst.* 116:372 (1883)

TYPE LOCALITY: "In places near the sea, Stewart Island; also on Puysegur Point, South Island."

Specimen SYNTYPE, The Old Neck, Stewart Island, T. Kirk, no date, AK 9438.

***Olearia uniflora*** Colenso, *Trans. Proc. N.Z. Inst.* 22:469 (1890)

TYPE LOCALITY: "Hills at Ohariu, West Coast, Cook Strait, near Wellington; and cultivated at Wanstead, near Waipukurau, County of Waipawa; Mrs E. Crosse."

Specimen: ? SYNTYPE, \* no locality, W. Colenso, no date, AK 9614.

***Olearia virgata*** Hook.f. var. *implicita* G. Simpson, *Trans. R. Soc. N.Z.* 75:199 (1945)

TYPE LOCALITY: "... the banks of the Maruia River, Nelson ..."

Specimen: SYNTYPE, \* Maruia River, Westland, George Simpson, no date, AK 22900.

***Olearia virgata*** Hook.f. var. *lineata* Kirk, *Stud. Fl.*:276 (1899)

TYPE LOCALITY: "North Island: from the East Cape and Hawke's Bay to Wellington, but local in many districts. South Island: Nelson to Foveaux Strait. Sea-level to 2,000 ft. Dec-Jan."

Specimen: SYNTYPE, Winton, Southland, T. Kirk, Dec 1883, AK 9651.

***Olearia virgata*** Hook.f. var. *rugosa* G. Simpson, *Trans. Proc. N.Z. Inst.* 75:199 (1945)  $\equiv$  ***O. bullata*** H. D. Wilson et Garn.-Jones, *N.Z. J. Bot.* 30:365 (1992)

TYPE LOCALITY: "... Mount Flagstaff, Dunedin ..."

Specimens: ? ISOLECTOTYPES, \* Flagstaff Hill, Dunedin, G. Simpson, no date, AK 22899, AK 210589 (formerly AK 22899b), (lectotype in CHR, † Wilson and Garnock-Jones 1992:365).

***Olearia willcoxii*** Petrie, *Trans. Proc. N.Z. Inst.* 45:266 (1913)

TYPE LOCALITY: "Queenstown Hill, Lake County."

Specimens: ? SYNTYPE, \* Queenstown Hill, Lake Co., W. Wilcox, no date, AK 9571 (ex Herb. D. Petrie); ? SYNTYPE or ? ISOSYNTYPE, AK 9572.

***Ozothamnus lanceolatus*** Buchanan, *Trans. Proc. N.Z. Inst.* 2:88 (1870)

TYPE LOCALITY: "... mountains of Hokianga 2000-3000 feet alt. Collected by Mr J. Buchanan."

Specimen: ? SYNTYPE, \* Mountains near Hokianga, J. Buchanan, no date, AK 10243.

***Pachystegia rufa*** Molloy in Connor and Edgar, *N.Z. J. Bot.* 25:144 (1987)

TYPE LOCALITY: "... Beaumont Ck, Haldon Hills, Marlborough, greywacke outcrop at 270 m, mixed scrub, B.P.J. Molloy, 6-1-1981."



Specimen: ISOTYPE, greywacke rock outcrop at 270 m, mixed scrub, B.P.J. Molloy, 6 Jan 1981, AK 176212 (ex CHR, †Molloy in Connor and Edgar 1987:144), (holotype in CHR, †Molloy in Connor and Edgar 1987:44).

***Pluerophyllum hookeri*** Buchanan, *Trans. Proc. N.Z. Inst.* 16:395 (1884)

TYPE LOCALITY: "Common on the hills around Perseverance Harbour, Campbell Island."

Specimen: ? SYNTYPE, \* Campbell Island, J. Buchanan, no date, AK 9672.

***Raoulia buchananii*** Kirk, *Stud. Fl.*:307 (1899)

TYPE LOCALITY: "South Island; Mount Alta, Buchanan!"

Specimen: SYNTYPE, \* Mt Alta, Otago, J. Buchanan, no date, AK 10095.

***Raoulia gibbsii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 42:216 (1910)

TYPE LOCALITY: "South Island: Dun Mountain Range, Nelson, on Mount Starveall and Slaty Peak; altitude, 4,000-5,000 ft; F.G. Gibbs!"

Specimens: SYNTYPES, \* Mount Starveall, Dun Mountain Range, 4000-5000 ft, F.G. Gibbs, no date, AK 10109; Slaty Peak, Dun Mountain Range, 4000-5000 ft, F.G. Gibbs, no date, AK 10110.

***Raoulia goyenii*** Kirk, *Trans. Proc. N.Z. Inst.* 16:373 (1884)

TYPE LOCALITY: "Summit of Rakiahua, P. Goyen! Peaks of Mount Anglem, 3,200 feet, T.K."

Specimen: SYNTYPE, \* Rakeahua, Stewart Island, P. Goyen, no date, AK 10087.

***Raoulia petriensis*** Kirk, *Trans. Proc. N.Z. Inst.* 9:549 (1877)

TYPE LOCALITY: "South Island: Mount St. Bathans, Otago, D.M. Petrie."

Specimens: SYNTYPE, \* Mt St Bathans, Otago, 4,500 ft, D. Petrie, no date, AK 10127; ? SYNTYPE, Mount St Bathans, no collector (label in Kirk's hand), no date, AK 30643 (ex Herb. T. Kirk, ex MO).

***Raoulia rubra*** Buchanan, *Trans. Proc. N.Z. Inst.* 14:349 (1882)

TYPE LOCALITY: "Mount Holdsworth, Tararua Range, North Island, 4,500 feet alt., 1882."

Specimens: ? SYNTYPES, \* probably from the Otago Alps, no collector, no date, AK 10086 (ex Herb. J. Buchanan); Mount Holdsworth, J. Buchanan and H.J. Logan, 1880, AK 10090.

***Raoulia tenuicaulis*** Hook.f. var. ***pusilla*** Kirk, *Stud. Fl.*: 302 (1899)

TYPE LOCALITY: "North Island: forming broad mossy patches on the Rimutaka Range. Nov."

Specimen: SYNTYPE, Rimutaka Range, no collector (label in Kirk's hand), no date, AK 10188 (ex Herb. T. Kirk).

***Senecio adamsii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 28:536 (1890)

TYPE LOCALITY: "Mount Arthur and Mount Peel, Nelson, not uncommon from 3,500 to 5,500 feet alt., T.F.C."

Specimen: SYNTYPE, Mt Arthur Plateau, 4,000 ft, T.F.C., Jan 1881, AK 10728.

***Senecio bellidioides*** Hook.f. var. ***setosus*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:37 (1942)

TYPE LOCALITY: "Subalpine scrub & grassland on Mount Fyffe, Kaikoura Mountains."  
Specimen: SYNTYPE, \* subalpine scrub & grassland on Mt Fyffe, Kaikoura Mountains, G.S. & J.S.T., no date, AK 35402.

*Senecio bennettii* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:39 (1942)

TYPE LOCALITY: "... upper forest margins, Mount Cargill, near Dunedin - 600 m altitude ..."

Specimen: SYNTYPE, \* Mt Cargill, near Dunedin, 600 m, J.S.T. & G.S., no date, AK 35247.

*Senecio bidwillii* Hook.f. var. *viridis* Cheeseman, *Man. N.Z. Fl.*:383 (1906)

TYPE LOCALITY: "Mountains of Nelson, Marlborough and Canterbury, from Mount Arthur to the Rakaia Valley, 2500-5000 ft. December-January."

Specimens: SYNTYPES, Arthur's Pass, Canterbury, 3000 ft, T.F.C., Jan 1883, AK 10774-10775.

*Senecio compactus* Kirk, *Trans. Proc. N.Z. Inst.* 12:395 (1880)

TYPE LOCALITY: "North Island: Castle Point, East Coast, on limestone rocks, descending to sea-level."

Specimen: SYNTYPE, Castle Point, East Coast, T.K., Feb 1880, AK 10716.

*Senecio glaucophyllus* Cheeseman, *Trans. Proc. N.Z. Inst.* 28:536 (1896)

TYPE LOCALITY: "Mount Arthur, Nelson, on limestone rocks; alt., 4,000 ft."

Specimens: LECTOTYPE, Mt Arthur, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 10601 (†Ornduff 1960:71); ISOLECTOTYPES, AK 10602, AK 10604.

*Senecio lapidosus* Cheeseman, *Trans. Proc. N.Z. Inst.* 48:213 (1916)

TYPE LOCALITY: "South Island: Faces of rocky cliffs at Hell's Gate, Mason River, North Canterbury, H.J. Matthews! (1909)."

Specimen: SYNTYPE, \* Hell's gates, Mason River, N. Canterbury, H.J. Matthews, 17 March 1909, AK 10724.

*Senecio lautus* Sol. ex Willd. var. *discoideus* Cheeseman, *Man. N.Z. Fl.*:374 (1906)

TYPE LOCALITY: "Mountain districts in the South Island."

Specimens: LECTOTYPE, Mt Torlesse, Canterbury Alps, 3500 ft, T.F.C., Jan 1880, AK 10596 (†Ornduff 1960:73); PARALECTOTYPE, mts behind Castle Hill, Canterbury, 4000 ft, T.F.C., Jan 1883, AK 10597.

*Senecio lautus* Sol. ex Willd. var. *montanus* Cheeseman, *Man. N.Z. Fl.*:373 (1906)

TYPE LOCALITY: "A common mountain plant in both the North & South Islands."

Specimens: SYNTYPES, \* Mount Owen, Nelson, 4000 ft, W. Townson, no date, AK 10589; Gordon's Nob, Nelson, alt 3000 ft, T.F.C., Jan 1882, AK 10590; Mount Arthur, Nelson, alt 4000 ft, T.F.C., Jan 1886, AK 10591-10592; Mt Tauhara, Taupo, alt 3000 ft, T.F.C., Jan 1889, AK 10593; \* Mt Arthur, Nelson, F. G. Gibbs, no date, AK 10594-10595.

*Senecio myrianthos* Cheeseman, *Trans. Proc. N.Z. Inst.* 7:348 (1875)

TYPE LOCALITY: "... Kaueranga River, Karaka, Tararu, and Puru Creeks; and other localities at the Thames."

Specimens(s): All the AK type material is missing (since at least 1941) but the following material is potential NEOTYPE: Kaueranga River, Thames, T.F.C., Nov 1881, AK 10688-10693.

***Senecio perdicioides*** Hook.f., *Fl. N.Z.* 1:149 (1853)

TYPE LOCALITY: "... Northern Island, Tolaga in woods, Banks and Solander."

Specimen: SYNTYPE, \* New Zealand, Banks and Solander, 1769-1770, AK 107097 (ex BM).

***Senecio rotundifolius*** Hook.f. var. ***ambiguus*** Cheeseman, *Man. N.Z. Fl.*:1026 (1925)

TYPE LOCALITY: "North-west Nelson - West Wanganui, H.J. Matthews! B.C. Aston, Cape Foulwind, near Westport, W. Townson! Petrie! Sea-level to 3500 ft. December-January."

Specimens: SYNTYPES, \* Cape Foulwind, near Westport, W. Townson, no date, AK 10757; Cape Foulwind, SW Nelson, D. Petrie, 4.2.1913, AK 10758-10759.

***Senecio rufiglandulosus*** Colenso, *Trans. Proc. N.Z. Inst.* 28:599 (1896)

TYPE LOCALITY: "... East sides of Ruahine Mountain-range, about 3,000 ft-4,000 ft altitude, on margins of watercourses and also on dry stony spots: Mr A. Olsen; 1894-95."

Specimen: ? SYNTYPE, \* no locality, no collector (label in Colenso's hand), no date, AK 10626.

***Senecio turneri*** Cheeseman, *Trans. Proc. N.Z. Inst.* 43:176 (1911)

TYPE LOCALITY: "North Island: On the faces of wet cliffs by the Upper Wanganui River, both above and below the junction of the Mangaio Stream: E. Phillips Turner!"

Specimens: SYNTYPES, \* wet cliffs, Upper Wanganui River, E. Phillips Turner, Nov 1910, AK 10632-10639.

***Trineuron pusillum*** Hook.f., *Fl. N.Z.* 1:131 (1853)

TYPE LOCALITY: "... Northern Island. Snowy places amongst the Ruahine Mountains, Colenso."

Specimen: SYNTYPE, \* New Zealand, Colenso, no date, AK 10472 (ex K).

## BIGNONIACEAE

***Tecomanthe speciosa*** W.R.B. Oliv., *Rec. Auck. Inst. Mus.* 3:233 (1948)

TYPE LOCALITY: "Type specimen in Auckland Museum

collected by E.G. Turbott on Great Island, Three Kings Group, May 12th 1946."

Specimens: SYNTYPES, \* Tasman Valley, stream bed, Great Island, Three Kings Islands, E.G. Turbott, 12 May 1946, AK 22987-22991, AK 22993.

## BORAGINACEAE

***Myosotis amabilis*** Cheeseman, *Man. N.Z. Fl.*:468 (1906)

TYPE LOCALITY: "North Island; Auckland - summit of Mount Hikurangi, East Cape District, altitude 5000 ft, Petrie and Adams! January."

Specimens: SYNTYPE, Mt Hikurangi, on shingle, 4000-5000 ft, no collector (label in Petrie's hand), no date, AK 7534; SYNTYPES or ISOSYNTYPES, \* Mt Hikurangi, East Cape, J. Adams, 21.1.1897, AK 47774 (ex Herb. J. Adams), AK 211972 (ex Herb. J. Adams).

***Myosotis angustata*** Cheeseman, *Man. N.Z. Fl.*:465 (1906)

TYPE LOCALITY: "South Island: Nelson - Mount Arthur Plateau and Raglan Mountains. T.F.C. 3500-4500 ft. January."

Specimens: SYNTYPES, Raglan Range, Wairau Valley, alt. 4500 ft, T.F.C., Jan 1881, AK 7471; Mt Arthur, Nelson, alt. 5000 ft, Jan 1886, AK 7472, AK 210593 (formerly AK 7472.2).

***Myosotis antarctica*** Hook.f. subsp. *traillii* Kirk, *Trans. Proc. N.Z. Inst.* 16:373 (1884)

TYPE LOCALITY: "Sandy places on the west coast of Stewart Island."

Specimen: SYNTYPE, Mason Bay, Stewart Island, T. Kirk, Jan 13 1882, AK 7443.

***Myosotis astonii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 42:217 (1910)

TYPE LOCALITY: "North Island: Mount Holdsworth, Tararua Range; altitude, 4,000-4,500 ft; W. Townson! B.C. Aston!"

Specimens: SYNTYPES, \* Mount Holdsworth, Tararua Range, B.C. Aston, January 1908, AK 7525; \* Mt Holdsworth, Tararua Range, W. Townson, Jan 1908, AK 7526-7527.

***Myosotis australis*** R. Br. var. *conspicua* Cheeseman, *Man. N.Z. Fl.*:462 (1906)

TYPE LOCALITY: "North Island: Hawke's Bay - Kaweka Mountain, H. Tryon. South Island: Abundant throughout. Sea-level to 4000 ft."

Specimen: SYNTYPE, Mt Torlesse, Canterbury Alps, 4500 ft, T.F.C., Jan 1880, AK 7492.

***Myosotis cheesemanii*** Petrie, *Trans. Proc. N.Z. Inst.* 18:296 (1886)

TYPE LOCALITY: "Mount Pisa Range (6,000 ft), on steep faces of shingle above the snow drifts."

Specimen: SYNTYPE, Mt Pisa, 6000 ft, no collector (label in Petrie's hand), no date, AK 7447.

***Myosotis cockayniana*** Petrie, *Trans. Proc. N.Z. Inst.* 45:269 (1913)

TYPE LOCALITY: "Shingle Range, Upper Awatere (Marlborough), 5000 ft... L. Cockayne ..."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, \* Shingly Range, upper Awatere, L. Cockayne, no date, AK 7469.

***Myosotis concinna*** Cheeseman, *Trans. Proc. N.Z. Inst.* 17:235 (1885)

TYPE LOCALITY: "Nelson, abundant on the debris of limestone rocks on Mount Owen, altitude 3,500-4,500 ft; also on Mount Arthur, altitude 4,000 ft, T.F.C."

Specimens: SYNTYPES, Mt Owen, Nelson, alt. 3500 ft, T.F.C., Jan 1882, AK 7548, AK 210592 (formerly AK 7548.2); Mount Owen, Nelson, alt. 4500 ft, T.F.C., no date, AK 7549.

***Myosotis decora*** Kirk ex Cheeseman, *Man. N.Z. Fl.*:462 (1906)

TYPE LOCALITY: "South Island: Canterbury - Limestone rocks in the Broken River basin. Enys! Kirk! Cockayne! T.F.C. 2000-3500 ft. December-January."

Specimens: SYNTYPES, limestone debris near cave at Broken River, 2100 ft, L.C., Jan 1893, AK 7448 (ex Herb. L. Cockayne); Castle Hill, Canterbury Alps, on limestone rock, T.F.C. & J.D. Enys, no date, AK 7449.

***Myosotis eximia*** Petrie, *Trans. Proc. N.Z. Inst.* 48:188 (1916)

TYPE LOCALITY: "Limestone bluffs and talus slopes of Mount Aorangi (Mangaohane Station), Ruahine Range, 3,900 ft."

Specimens: SYNTYPES or ISOSYNTYPE, \* Mount Aorangi, Mangaohane, Ruahine Mountains, B.C. Aston, Dec 1914, AK 7535; SYNTYPE, \* Mangaohane, Ruahine Mountains, 3900 ft, B.C. Aston, Dec 1914, AK 7536 (ex Herb. D. Petrie).

*Myosotis explanta* Cheeseman, *Man. N.Z. Fl.*:464 (1906)

TYPE LOCALITY: "South Island: Canterbury - Mountains above Arthur's Pass, T.F.C., Cockayne! Walker's Pass, Cockayne. 3000-4500 ft. January."

Specimens: SYNTYPES, mountains above Arthur's Pass, Canterbury Alps, alt. 4000 ft, T.F.C., Jan 1883, AK 7458-7459; Arthurs Pass, Canterbury Alps, 3,500 ft, T.F.C., no date, AK 7460; on rocks, shady side of Pass Creek - 1000 m, L. Cockayne, 8/1/97, AK 7461 (ex Herb. L. Cockayne).

*Myosotis goyenii* Petrie, *Trans. Proc. N.Z. Inst.* 23:400 (1891)

TYPE LOCALITY: "... Arrowtown ... Cardrona Valley, and at the bluff on the east side of Lake Hawea."

Specimens: ? SYNTYPES, Arrowtown, 1200 ft, no collector, no date, AK 7474; Arrowtown, D.P., 1890, AK 7475.

*Myosotis laeta* Cheeseman, *Trans. Proc. N.Z. Inst.* 17:236 (1885)

TYPE LOCALITY: "... on the Nelson mountains, altitude 2,000-4,000 feet. Red Hills, Wairau Valley; Mount Arthur Plateau; Mount Owen, etc. T.F.C."

Specimens: SYNTYPES, Red Hills, Wairau, Nelson, alt. 4000 ft, T.F.C., Jan 1882, AK 7531, AK 210594 (formerly AK 7531.2).

*Myosotis laingii* Cheeseman, *Trans. Proc. N.Z. Inst.* 44:161 (1912)

TYPE LOCALITY: "South Island: Kaikoura Mountains; J. Buchanan! Wairau Gorge; T.F.C. Lake Tennyson; R.M. Laing! Altitudinal range from 2,500 to 4,500 ft."

Specimens: SYNTYPES, \* Kaikoura Mountains, J. Buchanan, no date, AK 7532; \* Terraces by the Clarence River, near Lake Tennyson, Laing, no date, AK 7533.

*Myosotis macrantha* (Hook.f.) Benth. et Hook.f. var. *pulchra* Cheeseman, *Man. N.Z. Fl.*:471 (1906)

TYPE LOCALITY: "South Island: Subalpine localities from Nelson to the south-west of Otago; not uncommon especially in the central and western portions of the Southern Alps. 2000-5000 ft. December-February."

Specimens: SYNTYPES, Broken River, Canterbury, alt. 3000 ft, T.F.C., Jan 1880, AK 7561, AK 210595 (formerly AK 7561.2); Mount Arthur, Nelson, 4000 ft, T.F.C., Jan 1886, AK 7562, AK 210596-210598 (formerly AK 7562.2-7562.4).

*Myosotis macrantha* (Hook.f.) Benth. et Hook.f. var. *westlandica* Petrie, *Trans. Proc. N.Z. Inst.* 50:210 (1918)

TYPE LOCALITY: "In a moist shady ravine on Rangi Taipo, Jackson's, Taramakau River; about 4,000 ft: L. Cockayne, D.P."

Specimen: SYNTYPE, \* Rangi Taipo, Jackson's Taramakau, 4000 ft, L. Cockayne, Jan 1893, AK 7563 (ex Herb. D. Petrie).

*Myosotis monroi* Cheeseman, *Man. N.Z. Fl.*:469 (1906)

TYPE LOCALITY: "South Island: Nelson-Dun Mountain, Monro, Travers! Buchanan!

Kingsley! T.F.C.; Red Hills (Wairau Valley), T.F.C. 3000-4500 ft, December-February.”  
Specimens: SYNTYPES, \* Dun Mountains, Nelson, 3000 ft, no collector, no date, AK 7544 (ex WELT); Red Hills, Wairau Valley, Nelson, 3000 ft, T.F.C., Jan 1882, AK 7545; Dun Mountains, Nelson, 4000 ft, T.F.C., no date, AK 7546.

*Myosotis pygmaea* Colenso var. *glauc*a G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:26 (1943)

TYPE LOCALITY: “... the base of Mount Ida at 500 m altitude ...”

Specimen: SYNTYPE, \* type from base of Mount Ida at 500 m, G.S. & J.S.T., no date, AK 210591.

*Myosotis saxosa* Hook. f., *Fl. N.Z.* 1:202 (1853)

TYPE LOCALITY: “Northern Island. Crags at Titikura, east coast, Colenso.”

Specimen: SYNTYPE or ISOSYNTYPE, crags at Titikura, Northern Island, New Zealand, Colenso 1711, no date, AK 220521 (previously AK 7538).

*Myosotis tenericaulis* Petrie, *Trans. Proc. N.Z. Inst.* 50:209 (1918)

TYPE LOCALITY: “Inch-Clutha, Clutha County, about a mile from the Ramahapa station on the Catlins River railway line ...”

Specimen: SYNTYPE, Inch Clutha, no collector (label in Petrie’s hand), Jany 1892, AK 7445.

*Myosotis townsonii* Cheeseman, *Man. N.Z. Fl.*:1145 (1906)

TYPE LOCALITY: “South Island: Nelson-Brunner Range and Lyell Mountains, W. Townson! 3000-4500 ft.”

Specimens: SYNTYPES, \* Brunner Range, S.W. Nelson, alt. 3000-4500 ft, W. Townson, no date, AK 7529; Brunner Range, S.W. Nelson, W. Townson, no date, AK 7530.

## BRASSICACEAE (CRUCIFERAE)

*Cardamine bilobata* Kirk, *Stud. Fl.*:27 (1899)

TYPE LOCALITY: “South Island: Kurow and Naseby, Mount Ida Range, Hector Mountains, Otago. 2,000 ft to 3,000 ft Petrie!”

Specimen: SYNTYPE, Kurow, Waitaki River, D. Petrie, Oct 1892, AK 4451.

*Cardamine debilis* Banks et Sol. ex DC., *Syst.* 2:265 (1821)

TYPE LOCALITY: Protologue not obtained.

Specimens: SYNTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 100053-100054 (ex BM).

*Cardamine divaricata* Hook.f., *Fl. N.Z.* 1:13 (1852)

TYPE LOCALITY: “Hab. Northern Island, Oporaga, Banks and Solander. Auckland, Sinclair, Lyall. Bay of Islands, A. Cunn.”

Specimens: ? ISOLECTOTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 100055-100056 (ex BM), AK 184767 (ex BM), (lectotype in BM, †Garnock-Jones 1978:119)

*Cardamine enysii* Cheeseman ex Kirk, *Stud. Fl.*:28 (1899)

TYPE LOCALITY: “South Island: Canterbury: Broken River Basin, Cheeseman. Otago: Mount Ida Range, Petrie!”

Specimen: SYNTYPE, mountains near the source of the Broken River, 6500 ft, T.F.C., Jan 1880, AK 4422.

***Cardamine latesiliqua*** Cheeseman, *Trans. Proc. N.Z. Inst.* 15:298 (1883)

TYPE LOCALITY: "Nelson Mountains. Mount Arthur, not uncommon between 4,000-4,500 ft; Mt Owen, abundant on limestone rocks above 3,500 ft; Raglan Mountains, altitude 5,000 ft."

Specimens: SYNTYPES, slopes of Mount Arthur, Nelson, alt. 5500 ft, T.F.C., Jan 1881, AK 4416; Mount Owen, Nelson, alt. 4000 ft, T.F.C., Jan 1882, AK 4418; ? SYNTYPE, Mount Arthur, Nelson, alt. 4000 ft, T.F.C., no date, AK 4415.

***Lepidium australe*** Kirk, *Trans. Proc. N.Z. Inst.* 14:381 (1882)

TYPE LOCALITY: "South Island: Cape Whanbrow - T.K.; near Cromwell - D. Petrie."

Specimen: SYNTYPE, \* Cape Whanbrow, T. Kirk, no date, AK 4482.

***Lepidium banksii*** Kirk var. ***ovatum*** Kirk, *Stud. Fl.*:35 (1899)

TYPE LOCALITY: "South Island: Pelorus Sound, J. Rutland! Kenepuru, J. MacMahon!"

Specimen: SYNTYPE, \* Kenepuru, Mr J. McMahon, no date, AK 4472.

***Lepidium kirkii*** Petrie, *Trans. Proc. N.Z. Inst.* 22:439 (1890)

TYPE LOCALITY: "Gimmerburn district, Maniototo Plain, 1,100 ft."

Specimen: SYNTYPE, \* Maniototo Plains, Otago, D. Petrie, no date, AK 4477 (ex Herb. D. Petrie).

***Lepidium matau*** Petrie, *Trans. Proc. N.Z. Inst.* 19:323 (1887)

TYPE LOCALITY: "Alexandra South."

Specimens: SYNTYPES, Alexandra South, D. Petrie, Dec 10 1885, AK 4488 (ex Herb. D. Petrie); \* Alexandra South, Otago, D. Petrie, no date, AK 209545 (formerly AK 4488.2).

***Lepidium tenuicaule*** Kirk, *Trans. Proc. N.Z. Inst.* 14:381 (1882)

TYPE LOCALITY: "South Island, Cape Whanbrow ... originally discovered by Mr D. Petrie ..."

Specimen: ? SYNTYPE, \* Oamaru, Otago, D. Petrie, no date, AK 4483.

***Nasturtium gibbsii*** Cheeseman, *Man. N.Z. Fl.*:465 (1925)

TYPE LOCALITY: "South Island: Nelson - Ravines on the face of Mount Lockett, alt. 3500 ft, F.G. Gibbs!"

Specimens: SYNTYPES, \* Ravines on Mt Lockett, N.W. Nelson, F.G. Gibbs, no date, AK 4421, AK 212974-212979 (formerly AK 4421.2-4421.7).

## CALLITRICHACEAE

***Callitriche microphylla*** Colenso, *Trans. Proc. N.Z. Inst.* 20:190 (1888)

TYPE LOCALITY: "On the ground in forests, forming thickish beds; and also in water-courses, in open lands near Dannevirke (*sic*), County of Waipawa; 1887: W.C."

Specimens: ? SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 5076, AK 209397 (formerly AK 5076).

CAMPANULACEAE

*Wahlenbergia flexilis* Petrie, *Trans. Proc. N.Z. Inst.* 49:51 (1917)

TYPE LOCALITY: "Higher parts of Clarence Valley, Inland Kaikouras, Marlborough: end of December, 1915: B.C. Aston!"

Specimen: SYNTYPE, \* Swale River, Kaikoura Mountains, B.C. Aston, Dec 1915, AK 9256.

*Wahlenbergia marginata* (Thunb.) A.DC. var. *australis* Hatch, *Trans. R. Soc. N.Z.* 79:368 (1952)

TYPE LOCALITY: "... Laingholm ..."

Specimens: SYNTYPES, Laingholm, E. D. Hatch, 12.1950, AK 27442-27444 (ex Herb. E.D. Hatch).

*Wahlenbergia ramosa* G. Simpson, *Trans. R. Soc. N.Z.* 75:196 (1945)

TYPE LOCALITY: "... Seatoun, Wellington, by Mrs H.W. Samson."

Specimen: SYNTYPE, \* Seatoun, Wellington, G. Simpson, no date, AK 22890.

*Wahlenbergia saxicola* A.DC. var. *congesta* Cheeseman, *Man. N.Z. Fl.*:403 (1906)

TYPE LOCALITY: "Cape Foulwind, near Westport, W. Townson! Sea-level to 6000 ft, December-February."

Specimens: SYNTYPES, \* Cape Foulwind, near Westport, W. Townson, no date, AK 9257-9258, AK 209535 (formerly AK 9257).

CARYOPHYLLACEAE

*Colobanthus acicularis* Hook.f., *Handbk. N.Z. Fl.*:25 (1864)

TYPE LOCALITY: "Middle Island, dry rocky places, Wairau Gorge, alt. 4-5500 ft, Travers; Otago, Lake district, abundant, Hector and Buchanan."

Specimen: ISOSYNTYPE, \* Wairau Gorge, 4000-5500 ft, Travers, no date, AK 4086.

*Colobanthus billardiarei* Fenzl var. *alpinus* Kirk, *Trans. Proc. N.Z. Inst.* 27:356 (1895)

TYPE LOCALITY: "North Island: Ruahine and Tararua Mountains. South Island: Southern Alps. 1,500-4,500 ft."

Specimen: SYNTYPE, South Island, Wai-a-auua Valley, 4000 ft, no collector (label in Kirk's hand), no date, AK 4060 (ex Herb. T. Kirk).

*Colobanthus brevisepalus* Kirk, *Trans. Proc. N.Z. Inst.* 27:357 (1895)

TYPE LOCALITY: "South Island: Mount Mowatt, Awatere; 4000 ft; T. Kirk. Gorge Creek and Kurow, Otago, D. Petrie!"

Specimens: SYNTYPES, Kurow, Waitaki River, D. Petrie, Oct 1892, AK 4074; junction of the Clutha and Gorge Creek, near Alexandra S., D.P., no date, AK 4075 (ex Herb. D. Petrie); Mount Mouatt, Awatere, T. Kirk, no date, AK 4077.

*Colobanthus buchananii* Kirk, *Trans. Proc. N.Z. Inst.* 27:358 (1895)

TYPE LOCALITY: "South Island: Otago; Manuherikia Valley. J. Buchanan!"

Specimen: SYNTYPE, \* Manuherikia Valley, Otago, J. Buchanan, no date, AK 4090.



*Colobanthus monticola* Petrie, *Trans. Proc. N.Z. Inst.* 44:179 (1912)

TYPE LOCALITY: "Rocky faces of the Sealey Range, Mount Cook District, at 5,500 ft."

Specimen: SYNTYPE, \* Sealey Range, Mount Cook District, 5000 ft, D. Petrie, no date, AK 4046.

*Colobanthus muelleri* Kirk var. *multicaulis* Kirk, *Trans. Proc. N.Z. Inst.* 27:356 (1895)

TYPE LOCALITY: "South Island: Interior of Otago! J. Buchanan."

Specimen: SYNTYPE, \* interior of Otago, J. Buchanan, no date, AK 4071 (ex Herb. T. Kirk).

*Colobanthus muelleri* Kirk var. *strictus* Cheeseman, *Man. N.Z. Fl.*:67 (1906)

TYPE LOCALITY: "Mountains of Canterbury and Otago, T.F.C., Petrie!"

Specimen: LECTOTYPE, Hooker Valley, stony flats, 2000 ft, T.F.C., Jan 1898, AK 4080 (†Allan 1961:216).

*Colobanthus squarrosus* Cheeseman, *Trans. Proc. N.Z. Inst.* 28:534 (1896)

TYPE LOCALITY: "Mount Owen, Nelson, on limestone rocks; alt. 4,000 ft."

Specimens: SYNTYPES, \* Mount Owen, Nelson, alt. 4000 ft, W. Townson, no date, AK 4048; Mount Owen, Nelson, alt. 4000 ft, T.F.C., no date, AK 4049.

*Stellaria decipiens* Hook.f. var. *angustata* Kirk, *Stud. Fl.*:57 (1899)

TYPE LOCALITY: "Antipodes Island, T.K."

Specimen: SYNTYPE, Antipodes Island, no collector (label in Kirk's hand), no date, AK 4022 (ex Herb. T. Kirk).

*Stellaria minuta* Kirk, *Stud. Fl.*:57 (1899)

TYPE LOCALITY: "Mount Stokes, 3000 ft. J. MacMahon!, Westport, on the sea-bench, Dr. Gaze ..."

Specimen: SYNTYPE or ISOSYNTYPE, \* Mount Stokes, Marlborough, J.H. MacMahon, no date, AK 4030.

*Stellaria oligosperma* Colenso, *Trans. Proc. N.Z. Inst.* 18:257 (1886)

TYPE LOCALITY: "In the shaded forests, near Norsewood, County of Waipawa; 1883-85. W.C."

Specimen: ? SYNTYPE, in forest, Norsewood, Waipawa, W.C., no date, AK 4017.

*Stellaria pellucida* Colenso, *Trans. Proc. N.Z. Inst.* 27:383 (1895)

TYPE LOCALITY: "Interior deep forests near Dannevirke, County of Waipawa; March 1894, W. C."

Specimen: ? SYNTYPE, \* Dannevirke, H.B., W. Col., no date, AK 4018.

## CHENOPODIACEAE

*Atriplex buchananii* Kirk var. *tenuicaulis* Petrie, *Trans. Proc. N.Z. Inst.* 47:54 (1915)

TYPE LOCALITY: "Moist grassy stations by the seaside. Centre Island; T. Kirk! A small island off Ototara, near Oreti mouth; J. Crosby Smith!"

Specimen: SYNTYPE or ISOSYNTYPE, \* island opposite Ototara, near Oreti mouth, Southland, J. Crosby Smith, no date, AK 3961.

*Chenopodium buehnananii* Kirk, *Trans. Proc. N.Z. Inst.* 22:447 (1889)

TYPE LOCALITY: "New Zealand, North Island: Port Nicholson; J. Buchanan, T. Kirk. South Island: The Brother Rocks, Nelson; C. Robson! Maniototo Plains (1,800 ft); D. Petrie, T. Kirk, Centre Island, Foveaux Strait; T. Kirk."

Specimen: SYNTYPE, Port Nicholson, no collector (label in Kirk's hand), no date, AK 14782 (ex Herb. T. Kirk).

## CORIARIACEAE

*Coriaria angustissima* Hook.f., *Handbk. N.Z. Fl.*:47 (1864)

TYPE LOCALITY: "Northern Island: Mount Egmont, Dieffenbach; top of the Ruahine Range, Colenso. Middle Island: abundant in subalpine localities from Nelson, Sinclair, to Otago, Hector and Buchanan."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, Mt Alta, Wanaka Lake District, N.Z., no collector (label in Buchanan's hand), no date, AK 5090 (ex WELT).

## CORNACEAE

*Corokia buddleoides* A. Cunn. var. *linearis* Cheeseman, *Man. N.Z. Fl.*:686 (1925)

TYPE LOCALITY: "Upper Kaueranga Valley, Thames, T.F.C."

Specimens: SYNTYPES, Thames Goldfields, 2000 ft, T.F.C., 1873, AK 6730; Kaueranga Valley, Thames, T.F.C., Oct 1880, AK 6731.

*Corokia cheesemanii* Carse, *Trans. Proc. N.Z. Inst.* 45:276 (1913)

TYPE LOCALITY: "North Island: Spirits Bay, North Cape District; T.F.C.! Tauroa, in woods; H.B. Matthews! H.C."

Specimens: SYNTYPES, Shag Gully, H.C., Jan 1912, AK 6741, AK 6744-6747; Shag Gully, Tauroa, H.C., Oct 1912, AK 6742-6743; SYNTYPES or ISOSYNTYPES, Kapowairua, Spirits Bay, T.F.C., Jan 1896, AK 6738, AK 210757-210759 (formerly AK 6738.2-6738.4); \* Tauroa, Ahipara, R.H. Matthews, no date, AK 6739-6740.

*Corokia macrocarpa* Kirk, *Stud. Fl.*:224 (1899)

TYPE LOCALITY: "Chatham Islands, Dieffenbach, Gilbert Mair! H. Travers! Cox!"

Specimens: SYNTYPES, Chatham Islands, no collector (label in Kirk's hand), no date, AK 6735 (ex Herb. T. Kirk), AK 11537 (ex Herb. T. Kirk); no locality, no collector (label in Kirk's hand), no date, AK 11539 (ex Herb. T. Kirk); SYNTYPES or ISOSYNTYPES, \* Whangamarino Reserve, F.A.D. Cox, no date, AK 6736 (ex Herb. L. Cockayne); \* Chatham Islands, F.A.D. Cox, no date, AK 6737; forests near Whangamarino, Chatham Island, F.A.D. Cox, no date, AK 104276 (ex Herb. H.B. Matthews).

## CRASSULACEAE

*Crassula raumahanga*  $\equiv$  *Tillaea acutifolia*

*Tillaea acutifolia* Kirk, *Stud. Fl.*:143 (1899)  $\equiv$  *Crassula raumahanga* A. P. Druce, *N.Z. J. Bot.* 25:128 (1987)

TYPE LOCALITY: "North Island, Harunuiorangi (flowers not seen). South Island: Winton Forest, Southland, T.K. Dec."

Specimen: SYNTYPE, \* Winton Forest, Southland, T. Kirk, no date, AK 4557.

*Tillaea kirkii* Allan, *Fl. N.Z.* 1:199 (1961)

TYPE LOCALITY: "North Island, Miramar."

Specimens: ? ISOTYPES, \* Miramar, near Wellington, T. Kirk, no date, AK 4546; Miramar Peninsula, T. Kirk, no date, AK 4547 (holotype in WELT, †Allan 1961:199).

*Tillaea novae-zelandiae* Petrie, *Trans. Proc. N.Z. Inst.* 25:270 (1893)

TYPE LOCALITY: "Waipahi, Lake Waiholā, Lake Te Anau."

Specimen: SYNTYPE, Waipahi, Otago, no collector (label in Petrie's hand), Dec 1891, AK 4552 (ex Herb. D. Petrie).

*Tillaea novae-zelandiae* Petrie var. *obtusa* Kirk, *Stud. Fl.*:142 (1899)

TYPE LOCALITY: "South Island: Waipahi, Te Anau, Petrie."

Specimen: SYNTYPE, Lake Waiholā, no collector (label in Petrie's hand), no date, AK 4553 (ex Herb. D. Petrie).

#### DROSERACEAE

*Drosera flagellifera* Colenso, *Trans. Proc. N.Z. Inst.* 23:384 (1891)

TYPE LOCALITY: "Margins of streamlets, low open grounds, south of Dannevirke, County of Waipawa; December 1890: W.C."

Specimen: ? SYNTYPE, \* Waipawa, Hawkes Bay, W. Colenso, no date, AK 4531.

#### ELAEOCARPACEAE

*Aristotelia fruticosa* Hook.f. var. *rigidula* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:158 (1947)

TYPE LOCALITY: "... Flagstaff Hill near Dunedin."

Specimens: SYNTYPES, \* Flagstaff Hill, G. Simpson, no date, AK 22914-22920.

*Elaeocarpus dentatus* (J.R. et G. Forst.) Vahl var. *obovatus* Cheeseman, *Trans. Proc. N.Z. Inst.* 39:442 (1907)

TYPE LOCALITY: "Riwaka (north-west Nelson); H.J. Matthews!"

Specimen: SYNTYPE, \* Riwaka, Nelson, H.J. Matthews, no date, AK 5166.

#### EPACRIDACEAE

*Dracophyllum adamsii* Petrie, *Trans. Proc. N.Z. Inst.* 55:435 (1924)

TYPE LOCALITY: "Roadside near mouth of Awatere River, East Cape district: James Adams and D.P. Edge of forest near Peria (Mongonui): H. Carse! Various stations in North Cape district: T.F. Cheeseman!"

Specimens: SYNTYPES or ISOSYNTYPES, Watts Bush, H.C., 10 Oct 1913, AK 6934 (ex Herb. H. Carse); growing in open near Watts Bush, Peria, H.C., Sep 13, AK 6935 (ex Herb. H. Carse); growing in mixed forest, Watts Bush, Peria, H.C., 14 Sep 13, AK 6936 (ex Herb. H. Carse); growing in mixed bush, Watts Bush, Peria, H.C., 14 Sep 1913, AK 6937 (ex Herb. H. Carse); Watts Bush, Peria, H. Carse, 14 Sep 1913, AK 105779 (ex Herb. H. Carse, ex Herb.

H.B. Matthews), AK 211639 (formerly AK 105779, ex Herb. H. Carse, ex Herb. H.B. Matthews).

Note: No Cheeseman specimen(s) located.

***Dracophyllum latifolium*** A. Cunn. var. ***matthewsii*** Carse, *Trans. Proc. N.Z. Inst.* 48:238 (1916)

TYPE LOCALITY: "Dry ridges in hilly forests in the county."

Specimens: SYNTYPES, upper part of high ridge in forest mar., Peria Gum Hills, H.B.M. & H.C., Oct 1914, AK 6909 (ex Herb. H. Carse), AK 211640 (formerly AK 6909.2, ex Herb. H. Carse); \* in mixed forest hilly country, near Taumata Mahoe, vicinity of Kaitaia, elevation 1600 ft, H.B. Matthews, 2 Oct 1913, AK 6910 (ex Herb. H. Carse); \* Taumatamahoe Range, H. Carse, Oct 1913, AK 6911 (ex Herb. H. Carse); SYNTYPE or ISOSYNTYPE, on high ridge in forest near Peria Gumhills, no collector (label in Matthews's hand), Oct 1914, AK 105797 (ex Herb. H.B. Matthews).

***Dracophyllum muscoides*** Hook.f., *Handbk. N.Z. Fl.*:183 (1864)

TYPE LOCALITY: "Middle Island: alps of Otago, alt. 7-8000 ft, Hector and Buchanan."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, Mt Alta, 5-7000 ft, no collector (label in Buchanan's hand), no date, AK 7046 (ex WELT).

***Dracophyllum oliveri*** Du Rietz, *Svensk bot. Tidskr.* 24:374 (1930)

TYPE LOCALITY: Not stated.

Specimens: ? SYNTYPES or ? ISOSYNTYPES, \* Mount Rochfort, near Westport, D. Petrie, mid Feby 1913, AK 105780; Mt Rochfort, near Westport, D. Petrie, mid Feby 1913, AK 105781.

***Dracophyllum paludosum*** Cockayne, *Trans. Proc. N.Z. Inst.* 34:318 (1902)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, Chatham Island, Cox & Cockayne, Jan 1901, AK 6996; boggy ground, higher portion of Whangamarino, Chatham Island, L.C., no date, AK 6998; Chatham Island, L. Cockayne, Jan 01, AK 10526 (ex Herb. H.B. Matthews).

***Dracophyllum pubescens*** Cheeseman, *Man. N.Z. Fl.*:426 (1906)

TYPE LOCALITY: "South Island: Nelson - mountains near Westport, Townson! 1500-2500 ft."

Specimens: SYNTYPES, \* Denniston, near Westport, 1800 ft, W. Townson, no date, AK 7004, AK 211641 (formerly AK 7004.2); \* Mount Frederic, near Westport, alt. 3000 ft, W. Townson, no date, AK 7005; \* Mount Frederic, near Westport, W. Townson, no date, AK 7006.

***Dracophyllum recurvatum*** Colenso, *Trans. Proc. N.Z. Inst.* 29:93 (1889)

TYPE LOCALITY: "On high grounds from 2,000 ft to 3,000 ft alt., hills around Lake Waikare, County of Wairoa; 1888, Mr H. Hill."

Specimen: ? SYNTYPE, \* hills around Lake Waikare, County of Wairoa, Mr H. Hill, 1888, AK 6904.

***Dracophyllum rosmarinifolium*** R. Br. var. ***politum*** Cheeseman, *Man. N.Z. Fl.*:427 (1906)

TYPE LOCALITY: "Maungatua, near Dunedin, Petrie! Mount Anglem and Smith's lookout (Stewart Island), Kirk! 2500-5500 ft. December-March."

Specimens: SYNTYPES, \* Mount Anglem, Stewart Island, T. Kirk, no date, AK 7032; \* Mount Maungatua, near Dunedin, D. Petrie, no date, AK 7033.

*Dracophyllum townsonii* Cheeseman, *Man. N.Z. Fl.*:420 (1906)

TYPE LOCALITY: "South Island: Nelson - vicinity of Westport, Townson!"

Specimens: SYNTYPES, \* vicinity of Westport (Mount Buckland), W. Townson, no date, AK 6924; Mount Buckland, near Westport, W. Townson, no date, AK 6923, AK 6925-6926, AK 211642-211643 (formerly AK 6925.2-6925.3).

*Dracophyllum uniflorum* Hook.f. var. *acicularifolium* Cheeseman, *Man. N.Z. Fl.*:427 (1906)

TYPE LOCALITY: "Broken River basin, and other localities in the mountains of Canterbury, Kirk! Enys! T.F.C."

Specimen: SYNTYPE, \* Castle Rock, Canterbury Alps, J.D. Enys, 1885, AK 7027.

Note: No Cheeseman specimen(s) located.

*Dracophyllum uniflorum* Hook.f. var. *virgatum* Cheeseman, *Man. N.Z. Fl.*:427 (1906)

TYPE LOCALITY: "Westland - near Kumara, Kirk! Denniston, J. Caffin! 2000-4500 ft. December-March."

Specimen: SYNTYPE, \* between Kumara and Marsden, Westland, T. Kirk, no date, AK 7028.

*Dracophyllum urvilleanum* A. Rich. var. *montanum* Cheeseman, *Man. N.Z. Fl.*:424 (1906)

TYPE LOCALITY: "Mount Hikurangi; Tongariro and Ruapehu, Ruahine Mountains, Tararua Mountains, and apparently not uncommon in the mountains of the South Island, from 2500 ft to 4500 ft."

Specimens: ? SYNTYPES, \* Mount Duppa, Marlborough, J.H. Macmahon, no date, AK 6979; \* Mt Glasgow, Nelson, alt. 3000-4000 ft, W. Townson, no date, AK 6980; \* Mt Lyell, Buller Valley, 3-4000 ft, W. Townson, no date, AK 6981; \* Ruahine Mountains, 4000 ft, D. Petrie, no date, AK 7055.

*Dracophyllum viride* W.R.B. Oliv., *Trans. Proc. N.Z. Inst.* 59:699 (1929)

TYPE LOCALITY: "Mangonui County, North New Zealand ... Spirits Bay, Peria."

Specimen: SYNTYPE, forest, Spirit's Bay, W.R.B.O., 28/11/16, AK 105638.

*Epacris sinclairii* Hook.f., *Handbk. N.Z. Fl.*:179 (1864)

TYPE LOCALITY: "Northern Island, Herb. Sinclair."

Specimen: SYNTYPE, \* Northern Island, herb. Dr Sinclair, no date, AK 6873 (ex Herb. A. Sinclair).

*Leucopogon brevibarbis* Stschegl. *Bull. Soc. Nat. Mosc.* 32:14 (1859)

TYPE LOCALITY: "Prope Wellington, T.S. Ralph no. 11."

Specimen: SYNTYPE, \* near Wellington, T.S. Ralph no. 11, 1849-1852, AK 143169 (ex BM).

## ERICACEAE

***Gaultheria antipoda*** G. Forst. var. *erecta* Cheeseman, *Man. N.Z. Fl.*:689 (1925)

TYPE LOCALITY: "Abundant through-out from the North Cape southwards. Sea-level to 4000 ft."

Specimens: SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 6789; summit of Pirongia, alt. 2800 ft, T.F.C., Jan 1899, AK 6790; Coromandel, T.F.C., October 1882, AK 6791, AK 211638 (formerly AK 6791.2); Remuera, T.F.C., no date, AK 6792.

***Gaultheria antipoda*** G. Forst. var. *fluviatillis* Cheeseman, *Man. N.Z. Fl.*:689 (1925)

TYPE LOCALITY: "Abundant through-out from the North Cape southwards. Sea-level to 4000 ft."

Specimen: SYNTYPE, Whangarei River, T.F.C., no date, AK 6793.

***Gaultheria epiphyta*** Colenso, *Trans. Proc. N.Z. Inst.* 22:474 (1890)

TYPE LOCALITY: "Wood, south of Dannevirke, County of Waipawa; 1887-89; W.C."

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 6789.

***Gaultheria rupestris*** R. Br. var. *lanceolata* Cheeseman, *Man. N.Z. Fl.*:407 (1906)

TYPE LOCALITY: "North and South Islands: Not uncommon in hilly and mountainous districts from the Thames goldfields southwards. Sea-level to 5000 ft."

Specimen(s): Not located, present in 1949 (Cooper 1949). No potential Cheeseman neotypes identified.

## EUPHORBIACEAE

***Poranthera alpina*** Cheeseman ex Hook.f., *lc. Pl.* t1366B (1881)

TYPE LOCALITY: "New Zealand, Nelson Province, Port Arthur, alt. 4-500 to 5-800 ft. T.F. Cheeseman. H. Jay."

Specimen: SYNTYPE, Mt Arthur, Nelson, 5000 ft, T.F.C., Jan 1881, AK 5061.

## FABACEAE (PAPILIONACEAE)

***Carmichaelia acuminata*** Kirk, *Stud. Fl.*:114 (1899)

TYPE LOCALITY: "North Island: White Rock, East Coast. T.K."

Specimen: SYNTYPE, White Rock, East Coast, T. Kirk, no date, AK 4918.

***Carmichaelia aligera*** G. Simpson, *Trans. R. Soc. N.Z.* 75:250 (1945)

TYPE LOCALITY: "... collected by Miss L.B. Moore at Anawhata."

Specimens: SYNTYPE, \* Anawhata, West Coast, Auckland, L.B. Moore, no date, AK 103140 (ex Herb. G. Simpson); PARATYPES, Waitakerei (*sic*) River, T.F.C., May 1883, AK 4848, AK 209795-209796 (formerly AK 4848.2-4848.3).

***Carmichaelia angustata*** Kirk, *Stud. Fl.*:114 (1899)

TYPE LOCALITY: "South Island: Nelson: valley of the Buller; especially plentiful near the Lyall junction; T.K."

Specimen: SYNTYPE, junction of the Lyall and Buller, T.K., no date, AK 4903.

*Carmichaelia angustata* Kirk var. *pubescens* G. Simpson, *Trans. R. Soc. N.Z.* 75:243 (1945)

TYPE LOCALITY: "... the Longford Bridge, near Murchison, by Mr A.W. Wastney ..."

Specimen: SYNTYPE, \* cultivated, ex Longford Bridge over Buller R. near Murchison, A.W. Wastney, no date, AK 102866, (ex Herb. G. Simpson).

*Carmichaelia appressa* G. Simpson, *Trans. R. Soc. N.Z.* 75:263 (1945)

TYPE LOCALITY: "... Ellesmere Spit ..."

Specimen: SYNTYPE, \* Ellesmere Spit, G. Simpson, no date, AK 70625.

*Carmichaelia astonii* G. Simpson, *Trans. R. Soc. N.Z.* 75:276 (1945)

TYPE LOCALITY: "Limestone in the Ure and Inner Clarence Valleys and their tributaries, and at Weld Cone, Marlborough."

Specimens: SYNTYPE, \* isolated hill, mouth of the Ure River, Marlborough, G. Simpson, Feb 1937, AK 70629; PARATYPES, \* inland Kaikoura, no collector, Dec 1915, AK 103194-103196, AK 209782.

*Carmichaelia australis* R. Br. var. *strictissima* Kirk, *Stud. Fl.*:110 (1899)

TYPE LOCALITY: "White Cliffs, Taranaki, Cheeseman!"

Specimens: SYNTYPES or ISOSYNTYPES, White Cliffs, Taranaki, T.F.C., Jan 1885, AK 4855, AK 214595 (previously AK 4855.2).

*Carmichaelia curta* Petrie, *Trans. Proc. N.Z. Inst.* 25:271 (1893)

TYPE LOCALITY: "Waitaki River, at Duntroon and Kurow."

Specimen: SYNTYPE, \* Duntroon, Waitaki River, D. Petrie, March 1892, AK 4930, AK 209770.

*Carmichaelia curta* Petrie var. *glabra* G. Simpson, *Trans. R. Soc. N.Z.* 75:282 (1945)

TYPE LOCALITY: "... from near Waitaki Dam ..."

Specimen: SYNTYPE, \* near Waitaki Dam, Otago, G. Simpson, no date, AK 103182 (ex Herb. G. Simpson).

*Carmichaelia diffusa* Petrie, *Trans. Proc. N.Z. Inst.* 25:272 (1893)

TYPE LOCALITY: "East coast of Otago, near the mouth of the Otepopo River."

Specimens: SYNTYPES, near mouth of the Otepopo River, D. Petrie, no date, AK 4874 (ex Herb. D. Petrie); \* near mouth of the Otepopo River, D. Petrie, no date, AK 209776 (formerly AK 4874.2, ex Herb. D. Petrie).

*Carmichaelia enysii* Kirk var. *ambigua* G. Simpson, *Trans. R. Soc. N.Z.* 75:269 (1945)

TYPE LOCALITY: "... gravelly ground near Kurow, Waitaki Valley, North Otago."

Specimens: SYNTYPE, \* gravelly ground near Kurow Waitaki Valley, North Otago, G. Simpson, no date, AK 103141 (ex Herb. G. Simpson); PARATYPE, \* Naseby, no collector, Dec 1889, AK 103142.

*Carmichaelia glabrata* G. Simpson, *Trans. R. Soc. N.Z.* 75:243 (1945)

TYPE LOCALITY: "... the Pelorus River."

Specimen: SYNTYPE, \* banks of the Pelorus River, G. Simpson, no date, AK 209771 (ex Herb. G. Simpson).

*Carmichaelia grandiflora* Hook.f. var. *dumosa* Kirk, *Stud. Fl.*:111 (1899)

TYPE LOCALITY: "Broken River Basin."

Specimen: SYNTYPE, \* Broken River Basin, Canterbury, alt. 2000 ft, T. Kirk, no date, AK 4897.

*Carmichaelia hollowayi* G. Simpson, *Trans. R. Soc. N.Z.* 75:277 (1945)

TYPE LOCALITY: "... the foothills of Mt St Mary."

Specimen: SYNTYPE, \* foothills of Mt St Mary, North Otago, G. Simpson, no date, AK 103186 (ex Herb. G. Simpson).

*Carmichaelia juncea* Colenso ex Hook.f., *Fl. N.Z.* 1:51 (1852)

TYPE LOCALITY: "Northern and Middle Islands, East Cape, Sinclair, Hawke's Bay and Taupo, Colenso. Akaroa, Raoul ..."

Specimen: ? SYNTYPE, \* no locality, W. Colenso, no date, AK 4932.

*Carmichaelia kirkii* Hook.f. var. *strigosa* G. Simpson, *Trans. R. Soc. N.Z.* 75:267 (1945)

TYPE LOCALITY: "... terraces of the Poulter River, Upper Waimakiriri Basin."

Specimens: SYNTYPES, \* terraces, Poulter River, Upper Waimakiriri Basin, Canterbury, G. Simpson, no date, AK 103150 (ex Herb. G. Simpson), AK 103151; PARATYPES, \* Otepopo, D. Petrie, no date, AK 4876-4877, AK 209785-209786 (formerly AK 4876.2-4876.3).

*Carmichaelia lacustris* G. Simpson, *Trans. R. Soc. N.Z.* 75:282 (1945)

TYPE LOCALITY: "... shores below the Accomodation House, L. Manapouri."

Specimens: SYNTYPES, \* Lake Manapouri, Otago, H.J. Matthews, Feb 1909, AK 4936, AK 209783-209784 (formerly AK 4936.2-4936.3); \* shores of Lake Manapouri (below Accomodation House), G. Simpson, no date, AK 103181 (ex Herb. G. Simpson).

*Carmichaelia monroi* Hook.f. var. *longecarinta* G. Simpson, *Trans. R. Soc. N.Z.* 75:279 (1945)

TYPE LOCALITY: "... terraces above the Poulter River, Upper Waimakiriri River Basin, Canterbury."

Specimens: SYNTYPE, \* terrace, Poulter River, Upper Waimakiriri, Canterbury, G. Simpson, Jan 1938, AK 103183, (ex Herb. G. Simpson); PARATYPES, Mt Torlesse, Canterbury Alps, alt. 3000 ft, T.F.C., Jan 1880, AK 4833; Castle Hill, Canterbury Alps, alt. 2500 ft, T.F.C., Jany 1880, AK 4835; \* Porter's Pass, Canterbury, L.M. Cranwell & L.B. Moore, Jan 1931, AK 103184; old flood-plain of R. Waitaki, Kurow at 670 ft alt, L.C., 22/Nov/1919, AK 103185.

*Carmichaelia nigrans* G. Simpson, *Trans. R. Soc. N.Z.* 75:285 (1945)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, \* margins of Makaroa R., Lake Wanaka, L. W. Caskill, no date, AK 103180 (ex Herb. G. Simpson), AK 209773.

*Carmichaelia nigrans* G. Simpson var. *tenuis* G. Simpson, *Trans. R. Soc. N.Z.* 75:285 (1945)

TYPE LOCALITY: "... the Waiho River."

Specimen: SYNTYPE, \* Waiho River, Westland, G. Simpson, no date, AK 209772 (ex Herb. G. Simpson).

*Carmichaelia ovata* G. Simpson, *Trans. R. Soc. N.Z.* 75:260 (1945)



TYPE LOCALITY: "... the Awatere Valley, near Seddon, Marlborough."

Specimens: SYNTYPES, \* Awatere Valley, near Seddon, Marlborough, G. Simpson, no date, AK 102883-102884 (ex Herb. G. Simpson); PARATYPES, \* Awatere River, Marlborough, J.H. Macmahon, no date, AK 4940-4942, AK 209788-209790 (formerly AK 4940.2-4940.4), AK 209791-209793 (formerly AK 4941.2-4941.4).

*Carmichaelia petriei* Kirk, *Stud. Fl.*:111 (1899)

TYPE LOCALITY: "South Island: Otago: Clutha Valley: north of Clyde; valleys and terraces on east and west of the Dunstan mountains; Petrie!"

Specimen: SYNTYPE or ISOSYNTYPE, Dunstan Gorge, Cromwell, D.P., no date, AK 4865 (ex Herb. D. Petrie).

*Carmichaelia petriei* Kirk var. *minor* G. Simpson, *Trans. R. Soc. N.Z.* 75:271 (1945)

TYPE LOCALITY: "... flats at the Matukituki River near the forks to east & west."

Specimens: PARATYPES, growing amongst various other shrubs on dry hill side at Kingston, Lake Wakatipu, alt. 325 m, L. Cockayne, March 1897, AK 4862 (ex Herb. L. Cockayne); Cromwell, Otago, D. Petrie, no date, AK 4863; \* base of Mt Roy, Wanaka, L. Cockayne, 6.3.1919, AK 103164-103166; base of Mt Roy, Wanaka, L. Cockayne, 6.3.1919, AK 103162; \* Cromwell, Central Otago, E. Phillips Turner, no date, AK 103163 (ex Herb. E. Phillips Turner).

*Carmichaelia ramosa* G. Simpson, *Trans. R. Soc. N.Z.* 75:272 (1945)

TYPE LOCALITY: "... the northern slopes of Dansy's Pass, North Otago."

Specimens: SYNTYPE, \* between Dansy's Pass and Livingstone, N. Otago, G. Simpson, 28.1.1939, AK 70628 (ex Herb. G. Simpson); PARATYPES, \* Pigroot Creek, Central Otago, G. Simpson, Dec 1938, AK 103160; \* near Kyeburn, Otago Central, G. Simpson, Jan 1937, AK 103161.

*Carmichaelia rivulata* G. Simpson, *Trans. R. Soc. N.Z.* 75:264 (1945)

TYPE LOCALITY: "... old river bed of the Dobson River, above Lake Ohau."

Specimen: SYNTYPE, \* Old River Bed, Dobson River, above L. Ohau, G. Simpson, no date, AK 70624 (ex Herb. G. Simpson).

*Carmichaelia robusta* Kirk, *Stud. Fl.*:111 (1899)

TYPE LOCALITY: "South Island: Broken River Basin, 2,000 ft to 2,800 ft, Enys and T.K."

Specimen: SYNTYPE, \* Broken River Basin, Canterbury, alt. 2500 ft, T. Kirk, no date, AK 4868.

*Carmichaelia silvatica* G. Simpson, *Trans. R. Soc. N.Z.* 75:251 (1945)

TYPE LOCALITY: "... collected by Mr A.D. McKinnon at the Waipoua River ..."

Specimen: SYNTYPE, \* cultivated, ex Waipoua River, A.D. McKinnon, no date, AK 103110 (ex Herb. G. Simpson).

*Carmichaelia solandri* G. Simpson, *Trans. R. Soc. N.Z.* 75:254 (1945)

TYPE LOCALITY: "... Whakatane by Miss L.B. Moore."

Specimens: SYNTYPE, \* Whakatane, L.B. Moore, no date, AK 102897 (ex Herb. G. Simpson); PARATYPES, Mt Manaia, T.F.C., Aug 1878, AK 4846; sandhills near Woodhill,

T.F.C., June 1910, AK 4847, AK 209779 (formerly AK 4847.2), AK 209781 (formerly AK 4847.5); \* sandhills near Woodhill, T.F.C., June 1910, AK 209778 (formerly AK 4847.2), AK 209780 (formerly AK 4847.4).

*Carmichaelia violacea* Kirk, *Stud. Fl.*:112 (1899)

TYPE LOCALITY: "South Island. Coleridge Pass, 2,500 to 3,000 ft, Enys and T.K."

Specimens: SYNTYPE, \* Coleridge Pass, Canterbury, T. Kirk, no date, AK 4866.

*Carmichaelia virgata* Kirk, *Stud. Fl.*:112 (1899)

TYPE LOCALITY: "South Island: Otago, Petrie! Makarewa and Orepuke, Southland, T.K. Dec, Jan."

Specimens: SYNTYPES, \* Otago, D. Petrie ex Kirk, no date, AK 4873, AK 209787 (formerly AK 4873.2).

*Carmichaelia williamsii* Kirk, *Trans. Proc. N.Z. Inst.* 12:394 (1880)

TYPE LOCALITY: "North Island; Ruakokore Bay, Bay of Plenty, Hick's Bay - Archdeacon W.L. Williams."

Specimens: ISOSYNTYPES, \* East Cape, Bishop Williams, no date, AK 4824; \* Hicks Bay, East Cape District, Bishop Williams, no date, AK 4841; \* Hicks Bay, W.L. Williams, no date, AK 209794 (formerly AK 4841.2).

*Chordospartium stevensonii* Cheeseman, *Trans. Proc. N.Z. Inst.* 43:175 (1911)

TYPE LOCALITY: "South Island: foothills of the Seaward Kaikoura Mountains near the mouth of the Clarence River; altitude, 1,500-2,500 ft; Mr George Stevenson!"

Specimens: SYNTYPES, \* Waiautoa (Clarence Bridge) Marlborough, G. Stevenson, no date, AK 4947-4948, AK 210739-210740 (formerly AK 4947.2-4947.3), AK 210741-210743 (formerly AK 4948.2-4948.4).

## GENTIANACEAE

*Gentiana antarctica* Kirk, *Trans. Proc. N.Z. Inst.* 27:339 (1895)

TYPE LOCALITY: "Campbell Island."

Specimen: SYNTYPE, Campbell Island, no collector (label in Kirk's hand), no date, AK 7330 (ex Herb. T. Kirk), (Fig. 2).

*Gentiana antarctica* Kirk var. *imbricata* Kirk, *Trans. Proc. N.Z. Inst.* 27:340 (1895)

TYPE LOCALITY: "Campbell Island, T. Kirk."

Specimen: SYNTYPE, Campbell Island, no collector (label in Kirk's hand), no date, AK 7331 (ex Herb. T. Kirk).

*Gentiana antipoda* Kirk, *Trans. Proc. N.Z. Inst.* 27:340 (1895)

TYPE LOCALITY: "Antipodes Island: T. Kirk."

Specimens: SYNTYPES, Antipodes Island, no collector (label in Kirk's hand), no date, AK 7332-7333 (ex Herb. T. Kirk).

*Gentiana astonii* Petrie, *Trans. Proc. N.Z. Inst.* 48:187 (1916)

TYPE LOCALITY: "Limestone ridges, bare or covered with manuka scrub, near the sources of the Ure River, Marlborough; B.C. Aston!"

No .....

## The Cheeseman Herbarium

*Gentiana antarctica* T. Kirk  
Campbell Island

SOUTH ISLAND, NEW ZEALAND

Ex Herb. T. Kirk, F.L.S., Wellington, N.Z.

Fig. 2. Herbarium label of T. Kirk, 1890 (AK 7330), syntype of *Gentiana antarctica* (12 x 6 cm).

Specimens: ? SYNTYPES or ? ISOSYNTYPES, \* Kaikoura Mts, Marlborough, B.C. Aston, no date, AK 7304; ? SYNTYPES, \* Ure River, Marlborough, B.C. Aston, no date, AK 107114 (ex Herb. E. Phillips Turner); Growing on loose talus in river, no collector (label in Carse's hand), April 1915, AK 107115 (ex Herb. B.C. Aston, ex Herb. L. Cockayne); Benmore, 3000 ft, no collector (label in Carse's hand), 15 April 1915, AK 107116 (ex Herb. B.C. Aston, ex Herb. L. Cockayne).

*Gentiana cerina* Hook.f. forma *suberecta* Kirk, *Trans. Proc. N.Z. Inst.* 27:339 (1895)

TYPE LOCALITY: "Auckland Islands; sea-level to 900 ft."

Specimen: SYNTYPE, \* Auckland Islands, T. Kirk, no date, AK 7327.

*Gentiana chathamica* Cheeseman, *Man. N.Z. Fl.*:449 (1906)

TYPE LOCALITY: "Chatham Islands: Abundant in wet places, Travers! Miss Seddon! Cox and Cockayne!"

Specimens: SYNTYPES, \* peaty swamps, Chatham Islands, F.A.D. Cox, no date, AK 7181; \* Chatham Islands, in wet places, Miss Seddon, no date, AK 7182; Whangamarino Run, Cox & Cockayne, Jan 1901, AK 7183.

*Gentiana concinna* Hook.f., *Fl. Antarctica* 1:53 (1844)

TYPE LOCALITY: "Lord Auckland's Group; on the bleak and exposed faces of the mountains."

Specimen: SYNTYPE, \* Lord Auckland Group, J.D. Hooker, 1839-1843, AK 54670 (ex BM).

*Gentiana concinna* Hook.f. var. *robusta* Hook.f., *Fl. Antarctica* 1:53 (1844)

TYPE LOCALITY: "Campbell's Island, on the hills, abundant."

Specimen: SYNTYPE, \* Campbell Island, J.D. Hooker, 1839-1843, AK 209537 (ex BM).

***Gentiana filipes*** Cheeseman, *Trans. Proc. N.Z. Inst.* 28:536 (1896)

TYPE LOCALITY: "Mount Arthur, Nelson; alt. 4000 ft."

Specimen: SYNTYPE, Mt Arthur, Nelson, 5000 ft, T.F.C., Jan 1886, AK 7160.

***Gentiana gracilifolia*** Cheeseman, *Man. N.Z. Fl.*:1144 (1906)

TYPE LOCALITY: "South Island: Nelson - Peaty localities by the margin of small tarns on the Mount Arthur Plateau, alt. 3500-4500 ft, T.F.C., F.G. Gibbs! February-March."

Specimens: SYNTYPES, \* tarns on Mt Arthur Plateau, Nelson, alt. 4000 ft, F.G. Gibbs, Jan 1905, AK 7209; AK 7210; \* Mount Arthur Plateau, Nelson, 4000 ft, F.G. Gibbs, March 1905, AK 7211-7212.

***Gentiana lilliputiana*** C.J. Webb, *N.Z. J. Bot.* 28:1 (1990)

TYPE LOCALITY: "Upper Lauder Creek, Dunstan Mountains, Central Otago, D. Bruce, Jan 1985."

Specimen: PARATYPE, N.Z., Central Otago, Dunstan Mountains, upper Lauder Creek, D. Bruce, Jan 1985, AK 209141 (ex CHR, †Webb 1990:1), (holotype in CHR, †Webb 1990:1).

***Gentiana lineata*** Kirk, *Trans. Proc. N.Z. Inst.* 27:334 (1895)

TYPE LOCALITY: "South Island: Hollows on the crest of the Longwood Range, Southland (1887); T. Kirk."

Specimens: SYNTYPES, Longwood Range, Southland, no collector (label in Kirk's hand), no date, AK 7161 (ex Herb. T. Kirk); \* Longwood Range, Southland, T. Kirk, no date, AK 7163.

***Gentiana montana*** G. Forst. var. *stolonifera* Cheeseman, *Man. N.Z. Fl.*:451 (1906)

TYPE LOCALITY: "Nelson - Mount Frederic, Mount Rochfort, Mount Buckland, and other peaks on the coast ranges near Westport, abundant, W. Townson! Otago - Dusky Sound, Forster, Anderson, Lyall. 2000-4000 ft. January-March."

Specimens: SYNTYPES, Mount Rochfort, near Westport, 2,500 ft, near scrub, W. Townson, no date, AK 7205; \* Mount Frederick, near Westport, 3,000 ft, W. Townson, no date, AK 7206; Mount Rochfort, near Westport, 3000 ft, W. Townson, no date, AK 7207.

***Gentiana novae-zelandiae*** J.B. Armstr., *Trans. Proc. N.Z. Inst.* 4:291 (1872)

TYPE LOCALITY: "Sources of the Rangitata River, Armstrong!"

Specimen: SYNTYPE, Southern Alps, J.B. Armstrong, no date, AK 7179.

***Gentiana serotina*** Cockayne, *Trans. Proc. N.Z. Inst.* 47:113 (1915)

TYPE LOCALITY: "South Island: Canterbury - Growing in tussock steppe of upper part of the Canterbury Plain and the Malvern Hills. L.C."

Specimens: SYNTYPES, growing on stony ground in full sunshine - upper Canterbury Plain, nr. Springfield, 660 m, L. Cockayne, 6 April 1899, AK 7240 (ex Herb. L. Cockayne); Upper Canterbury Plains, L. Cockayne, Apr 99, AK 209538 (ex Herb. H.B. Matthews).

***Gentiana tenuifolia*** Petrie, *Trans. Proc. N.Z. Inst.* 45:270 (1913)

TYPE LOCALITY: "Lyell Creek, 1,000 ft, and Boundary Peak, near edge of scrub (south-west Nelson), 4000 ft ... Mr Townson ..."

Specimens: ? SYNTYPES, \* Lyell Creek, Buller Valley, 1000 ft, W. Townson, no date, AK 7184; \* Boundary Peak, Lyell District, 2000 ft, W. Townson, no date, AK 7185.

***Gentiana tereticaulis*** Petrie, *Trans. Proc. N.Z. Inst.* 49:51 (1917)

TYPE LOCALITY: "Gentle grassy slopes at the foot of Lake Harris, Routeburn Valley, Lake County."

Specimen: SYNTYPE, \* Lake Harris, Otago, D. Petrie, no date, AK 7191.

***Gentiana townsonii*** Cheeseman, *Man. N.Z. Fl.*:450 (1906)

TYPE LOCALITY: "Nelson - Bidwill (n. 67 in Herb. Kew, fide N.E. Brown); coast ranges near Westport, Mount Frederic, Mount Rochfort, Mount Buckland, &c., Townson! Sounds of the south-west coast of Otago, Lyall (fide N.E. Brown). 1000-4000 ft."

Specimens: SYNTYPES, \* Mount Rochfort, near Westport, alt. 3000 ft, W. Townson, no date, AK 7213; Mount Buckland, near Westport, 4000 ft, W. Townson, no date, AK 7214; \* mountains near Westport, 2500 ft, W. Townson, no date, AK 7216-7219; \* Mount Frederic, near Westport, 2500 ft, W. Townson, no date, AK 7220-7221, AK 209539 (formerly AK 7220.2).

***Gentiana vernicosa*** Cheeseman, *Man. N.Z. Fl.*:1145 (1906)

TYPE LOCALITY: "South Island: Nelson - Mount Lockett (to the north of Mount Arthur), alt. 3500-4500 ft, F.G. Gibbs!"

Specimens: SYNTYPES, \* Mt Lockett, 4000 ft, F.G. Gibbs, no date, AK 7268; \* Mt Lockett, 4000 ft, F.G. Gibbs, March 1903, AK 7269, AK 209540 (formerly AK 7269).

#### GERANIACEAE

***Geranium microphyllum*** Hook.f. var. ***discolor*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:156 (1943)

TYPE LOCALITY: "... the Port Hills near Christchurch ..."

Specimen: SYNTYPE, \* no locality, G. Simpson, no date, AK 22909.

***Geranium microphyllum*** Hook.f. var. ***obtusatum*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:156 (1943)

TYPE LOCALITY: "... from Flagstaff Hill, near Dunedin ..."

Specimen: SYNTYPE, \* Flagstaff Hill, Dunedin, G. Simpson, no date, AK 22911.

#### GOODENIACEAE

***Sellieria fasciculata*** Buchanan, *Trans. Proc. N.Z. Inst.* 31:211 (1871)

TYPE LOCALITY: "Collected by Dr Haast at Weka Pass, Canterbury."

Specimen: SYNTYPE, \* Weka Pass, North Canterbury, no collector, no date, AK 9261 (ex Herb. J. Buchanan).

#### GUNNERACEAE

***Gunnera arenaria*** Cheeseman in Kirk, *Trans. Proc. N.Z. Inst.* 27:348 (1895)

TYPE LOCALITY: "North Island: on sand-dunes, Waitakerei River, T.F. Cheeseman!"

Specimen: SYNTYPE, Waitakerei (*sic*) River, T.F.C., Nov 1870, AK 6029.

***Gunnera densiflora*** Hook.f., *Handbk. N.Z. Fl.*:68 (1864)

TYPE LOCALITY: "Middle Island: Acheron and Clarence Rivers, alt. 4000 ft. Travers."

Specimen: SYNTYPE, \* Acheron and Clarence Rivers, Nelson, 4000 ft, Travers, no date, AK 6018 (Specimen annotated "Fruit from the type! from Kew Herbarium. This may be kept.").

***Gunnera densiflora*** Hook.f. var. ***depressa*** Kirk, *Trans. Proc. N.Z. Inst.* 17:347 (1895)

TYPE LOCALITY: "Southland; T. Waugh!"

Specimen: SYNTYPE, \* Sandy Point, T. Waugh ex T. Kirk, no date, AK 6032.

***Gunnera dentata*** Kirk, *Trans. Proc. N.Z. Inst.* 27:346 (1895)

TYPE LOCALITY: "North Island: Colenso (in Handbook); Petrie. South Island: Nelson to Southland, but often local; 1000 ft-3000 ft."

Specimens: SYNTYPES or ISOSYNTYPES, \* Lake Wanaka, D. Petrie, no date, AK 6025; \* Lake Hawea, D. Petrie, no date, AK 6026.

***Gunnera hamiltonii*** Kirk ex W.S. Ham., *Trans. Proc. N.Z. Inst.* 17:292 (1885)

TYPE LOCALITY: "... occurring in patches on the hills near the New River Heads."

Specimen: SYNTYPE, \* mouth of the Oreti River, Southland, W.S. Hamilton, no date, AK 6033.

***Gunnera monoica*** Raoul var. ***ramulosa*** Kirk, *Stud. Fl.*:152 (1899)

TYPE LOCALITY: "South Island: Broken River, Enys! 2800 ft."

Specimen: ? SYNTYPE, \* Broken River, Canterbury, J.D. Enys, no date, AK 5988.

***Gunnera strigosa*** Colenso, *Trans. Proc. N.Z. Inst.* 15:322 (1883)

TYPE LOCALITY: "On clay banks in forest between Norsewood and Dannevirke, Hawkes Bay District, North Island, flowering in November, 1881-1882, W.C."

Specimen: ? SYNTYPE, \* Matamau, Hawkes Bay, W. Colenso, no date, AK 5997.

## HALORAGACEAE

***Haloragis aggregata*** Buchanan, *Trans. Proc. N.Z. Inst.* 4:224 (1872)

TYPE LOCALITY: "Collected by H.H. Travers, near Lake Guyon, Nelson Province, February 1871."

Specimens: LECTOTYPE, \* Nelson Province, H.H. Travers, no date, AK 5937 (†Orchard 1975:180); ISOLECTOTYPE, \* Lake Guyon, H. Travers and J. Buchanan, no date, AK 5938 (†Orchard 1975:180).

***Haloragis cartilaginea*** Cheeseman, *Trans. Proc. N.Z. Inst.* 29:390 (1897)

TYPE LOCALITY: "Cliffs near the North Cape; not uncommon."

Specimens: SYNTYPES, cliffs at the North Cape, T.F.C., January 1896, AK 5919 (†Orchard 1975:78), AK 209569 (formerly 5919.2, †Orchard 1975:78)

***Haloragis minima*** Colenso, *Trans. Proc. N.Z. Inst.* 18:259 (1886)

TYPE LOCALITY: "Tarawera, high lands between Napier and Taupo, December 1884; Mr H. Hill."

Specimen: ISOLECTOTYPE, \* Tarawera between Napier and Taupo, H. Hill for W. Colenso, 1885, AK 133495 (†Orchard 1975:238), (lectotype in WELT, †Orchard 1975:238).

***Haloragis spicata*** Petrie, *Trans. Proc. N.Z. Inst.* 19:325 (1887)

TYPE LOCALITY: "Moist terraces, top of Lake Hawea, 1,150 ft."

Specimens: ISOLECTOTYPES, Hunter River, Hawea Lake, 1100 ft, D. Petrie, Feb 1886, AK 5939 (†Orchard 1975:181), AK 209568 (formerly AK 5939, †Orchard 1975:181), (lectotype in WELT, †Orchard 1975:181).

***Haloragis tetragyna*** (Labill.) Hook.f. var. *diffusa* Hook.f., *Fl. N.Z.* 1:62 (1852)

TYPE LOCALITY: "Northern Island, abundant in dry places, Banks and Solander, Cunningham etc."

Specimen: ? SYNTYPE, \* New Zealand, Banks and Solander, 1769-1770, AK 100922 (ex BM).

***Haloragis uniflora*** Kirk, *Trans. Proc. N.Z. Inst.* 9:548 (1877)

TYPE LOCALITY: "South Island: the Bluff Hill, Southland."

Specimen: ISOLECTOTYPE, \* Bluff Hill, Southland, T. Kirk, no date, AK 5942 (†Orchard 1975:181), (lectotype in WELT, †Orchard 1975:181).

***Myriophyllum triphyllum*** Orchard, *Brunnonia* 2:259 (1980)

TYPE LOCALITY: "A.E. Orchard, 4916, New Zealand, South Island, Springs County, Lower Selwyn Huts, Lake Ellesmere ..."

Specimen: HOLOTYPE, South Island, Springs County, Lower Selwyn Huts, Lake Ellesmere, A.E. Orchard 4916, 24.ii.1977, AK 142779 (†Orchard 1980:259).

***Myriophyllum votschii*** Schindl., *Pflanzenr.* 23:85 (1905)

TYPE LOCALITY: "Neu-Seeland: Nord-Insel, nahe Auckland (Hooker f.), nahe Manukau-Hafen (Cheeseman n. 1724); Omatangi, Taupo (Bergren); Lyall's Bay (Hector)-Herb. Barb-Boiss, Berlin, Deless. Petersb."

Specimens: ISOSYNTYPES, North Manukau Heads, T.F.C., Dec 1882, AK 5967; Manukau Heads, on wet sand, T.F.C., December 1884, AK 5968, AK 210724 (formerly AK 5968.2); \* North Manukau Heads, T.F.C., Dec 1884, AK 5969.

## ICANINACEAE

***Plectomirtha baylisiana*** W.R.B. Oliv., *Rec. Auck. Inst. Mus.* 3:225 (1948)

TYPE LOCALITY: "Great Island: Only one tree found. On a steep scree of large greywacke boulders facing the sea and about 700 ft above it. Type specimen in the Auckland Museum, collected by G.T.S. Baylis on Great Island, Three Kings Group, December 2nd, 1945."

Specimens: HOLOTYPE, \* Great Island, Three Kings, G.T.S. Baylis, 02/12/45, AK 22872; ISOTYPES, AK 22873-22875, AK 210753 (formerly AK 22872B).

## LAMIACEAE (LABIATAE)

***Mentha consimilis*** Colenso, *Trans. Proc. N.Z. Inst.* 18:264 (1886)

TYPE LOCALITY: "Dry grassy spots, margins of woods near Norsewood, County of Waipawa; 1882-85: W.C."

Specimen: ? SYNTYPE, \* Norsewood, Hawkes Bay, W. Colenso, 1885, AK 7592.

## LAURACEAE

***Beilschmedia tawaroa*** A.E. Wright, *N.Z. J. Bot.* 22:119 (1984)

TYPE LOCALITY: "New Zealand, North Island, Hen and Chickens Island Group, Motumuka (Lady Alice) Island, on top of Tawaroa ridge, the ridge forming the western side of the Korimako Bay, altitude c. 75 m, latitude 35°53.8' S, longitude 174°43.9' E. A.E. Wright 6415, 7.i.1982".

Specimens: HOLOTYPE, Hen and Chickens Group, Motumuka (Lady Alice) Island, Korimako Bay, western side, on top of the Tawaroa ridge, A.E. Wright, 7 January 1982, AK 156145 (†Wright 1984:119); ISOTYPE, AK 156146 (†Wright 1984:119).

***Laurus tawa*** A. Cunn., *Ann. Nat. Hist.* 1:379 (1838)

TYPE LOCALITY: "New Zealand, (Northern Island) - 1769, Sir Joseph Banks. A tree forty to sixty feet high, frequent in shaded moist forests, at the Bay of Islands, &c. - 1826, A. Cunningham - 1834, R. Cunningham"

Specimens: ISOLECTOTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 99633 (ex BM), AK 99634 (ex BM, †Wright 1984:115) (lectotype in K, †Wright 1984:115).

## LENTIBULARIACEAE

***Utricularia delicatula*** Cheeseman, *Man. N.Z. Fl.*:561 (1906)

TYPE LOCALITY: "North Island: Auckland - near Kaitaia, T.F.C.; near Waiuku, H. Carse! Swamps near Ohaupo (Waikato), T.F.C., November-January."

Specimens: LECTOTYPE, swamps near Ohaupo, Waikato, T.F.C., no date, AK 8625 (†Taylor 1989:182); PARALECTOTYPES, Mangatete, near Kaitaia, T.F.C., Jan 1896, AK 8626; sphagnum bogs near Kaitaia, T.F.C., no date, AK 8627.

***Utricularia mairii*** Cheeseman, *Man. N.Z. Fl.*:560 (1906)

TYPE LOCALITY: "North Island: Auckland - Lake Rotomahana, Kirk and Captain G. Mair! (1872)."

Specimen: HOLOTYPE, \* Lake Rotomahana, T. Kirk and Capt. G. Mair, 1872, AK 8615 (†Taylor 1989:600).

***Utricularia protrusa*** Hook.f., *Fl. N.Z.* 1:206 (1854)

TYPE LOCALITY: "Northern Island. Bogs, Bay of Plenty, Colenso."

Specimens: NEOTYPE, \* Waiharakeke Stream, Piako, Mr Allan, March 1909, AK 8611 (†Allan 1961:955, †Taylor 1989:599); ISONEOTYPE, \* Waiharakeke Stream, P.H. Allan, March 1909, AK 8612.

## LOGANIACEAE

***Geniostoma ligustrifolium*** A. Cunn. var. ***crassum*** Cheeseman, *Trans. Proc. N.Z. Inst.* 29:392 (1897)

TYPE LOCALITY: "Cliffs near the North Cape; not common."

Specimen: SYNTYPE, cliffs at the North Cape, T.F.C., January 1896, AK 7151.

***Geniostoma ligustrifolium*** A. Cunn. var. ***major*** Cheeseman, *Man. N.Z. Fl.*:444 (1906)

TYPE LOCALITY: "Three Kings Islands, abundant, T.F.C."



Specimens: SYNTYPES, Three Kings Islands, T.F.C., Nov 1889, AK 7150, AK 209493-209494 (formerly AK 7150.2-7150.3).

***Mitrasacme montana*** Hook.f. var. ***helmsii*** Kirk, *Trans. Proc. N.Z. Inst.* 22:445 (1890)

TYPE LOCALITY: "South Island - Paparoa Ranges, Westland, 3,000 ft, R. Helms."

Specimen: SYNTYPE or ISOSYNTYPE, \* Paparoa Range, 2800' elevation, R.H., 5/7/88, AK 7141.

## LORANTHACEAE

***Loranthus adamsii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 13:296 (1881)

TYPE LOCALITY: "Thames Goldfields, parasitic on *Coprosma*, *Myrsine* and *Melicope*."

Specimens: SYNTYPE, \* Thames goldfields, J. Adams, no date, AK 3842; ? SYNTYPE, \* Thames, J. Adams, no date, AK 3844.

***Loranthus colensoi*** Hook.f.,  *Ic. Pl.* 10:t663 (1884)

TYPE LOCALITY: "New Zealand, Northern Island. Abundant, growing parasitically on branches of *Metrosideros tomentosa*, near Lake Waikare. W. Colenso, Esq."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, \* Lake Waikare Moana, W. Colenso, no date, AK 3826.

***Loranthus fieldii*** Buchanan, *Trans. Proc. N.Z. Inst.* 16:397 (1884)

TYPE LOCALITY: "... near the base of Ruapehu on *Fagus* sp."

Specimen: SYNTYPE, \* ? base of Ruapehu, ? Mr Field, no date, AK 3839.

***Loranthus polychroa*** Colenso, *Trans. Proc. N.Z. Inst.* 17:241 (1885)

TYPE LOCALITY: "Parasitical and high up on trunks of *Fagus solandri*; woods near Norsewood, County of Waipawa, but scarce; March, 1884: W. C. Specimens, flowers and leaves picked up."

Specimen: ? SYNTYPE, on trunk of *Fagus solandri*, Norsewood, Waipawa Co., Rev. W. Colenso, no date, AK 3845 (Fig. 3).

***Tupeia undulata*** Colenso, *Trans. Proc. N.Z. Inst.* 16:329 (1884)

TYPE LOCALITY: "Parasitical on *Panax arboreum*, Petane Valley, near Napier, 1883, Mr A. Hamilton."

Specimens: ? SYNTYPES, \* on *Panax arboreum*, Petane, Napier, A. Hamilton, no date, AK 3857, AK 210754 (formerly 3857.2).

## MALVACEAE

***Hoheria populnea*** A. Cunn. var. ***acutifolia*** Kirk, *Stud. Fl.*:72 (1899)

TYPE LOCALITY: "North and South Islands: East Cape to Otago."

Specimen: SYNTYPE, Crofton, no collector (label in Kirk's hand), no date, AK 5223 (ex Herb. T. Kirk).

***Hoheria sexstylosa*** Colenso, *Trans. Proc. N.Z. Inst.* 17:238 (1885)

TYPE LOCALITY: "Skirts of woods and thickets, Norsewood, Matamau and Tahoraiti, County of Waipawa; 1883-84: W.C."

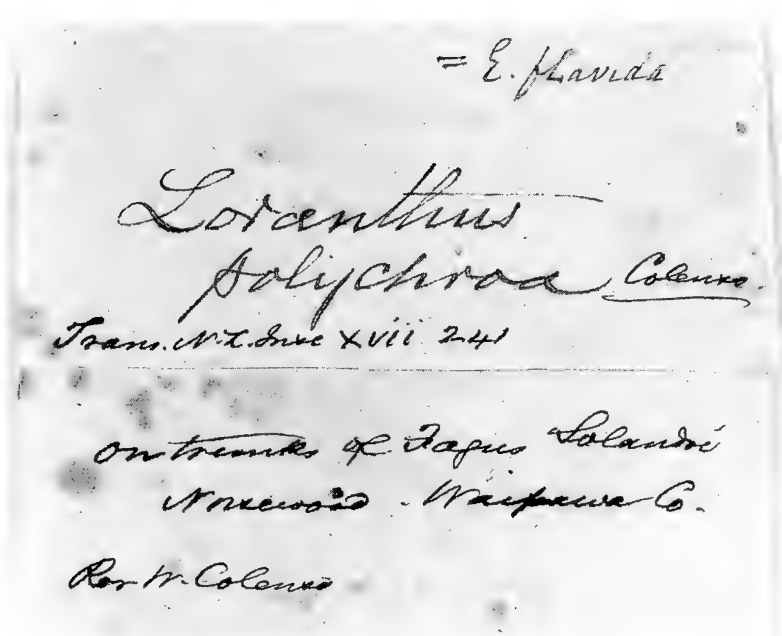


Fig. 3. Herbarium label of W. Colenso, undated (AK 3845), ? syntype of *Loranthus polychroa* (10 x 9 cm).

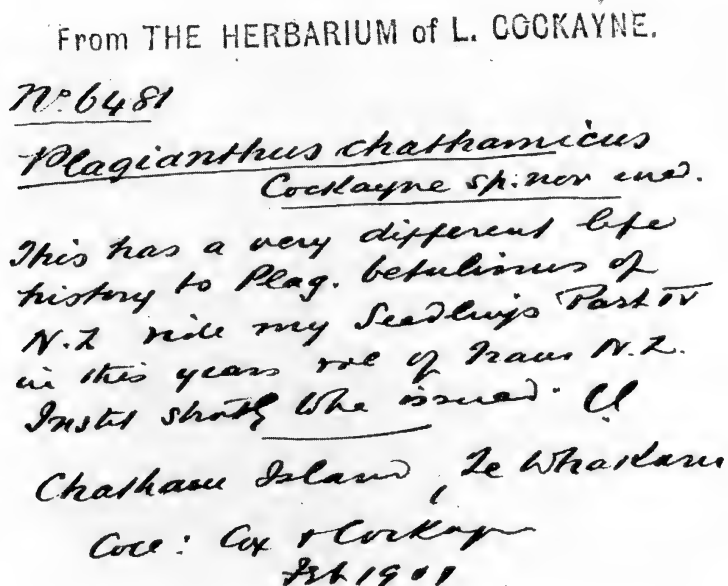


Fig. 4. Herbarium label of L. Cockayne, 1901 (AK 5208), syntype of *Plagianthus chathamicus* (9.5 x 8 cm).

Specimens: ? SYNTYPES, \* Hawkes Bay (Norsewood), W. Colenso, no date, AK 5214, AK 209768 (formerly AK 5214.2).

***Plagianthus chathamicus*** Cockayne, *Trans. Proc. N.Z. Inst.* 34:319 (1902)

TYPE LOCALITY: "Chatham Islands."

Specimen: SYNTYPE, Chatham Island, Te Whakaru, Cox and Cockayne, Feb 1901, AK 5208 (ex Herb. L. Cockayne) (Fig. 4).

## MORACEAE

***Paratrophis banksii*** Cheeseman, *Man. N.Z. Fl.*:633 (1906)

TYPE LOCALITY: "North Island: Usually near the sea. Bay of Islands, Colenso! Whangarei Heads and Hen and Chicken Islands, T.F.C.; Great Barrier Island; Omaha, Kirk! Cuvier Island, T.F.C.; Cabbage Bay, Adams! East Cape District, Banks and Solander, Bishop Williams! Petrie! Cook Strait, Kirk! Stephen Island, H.H. Travers!"

Specimens: SYNTYPES, Cuvier Island, T.F.C., Oct 1895, AK 3767, AK 209777 (formerly AK 3767.2); Taranga Islands, T.F.C., May 1880, AK 3768; Pataua River, Whangarei Heads, T.F.C., Nov 1896, AK 3769.

***Paratrophis smithii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 20:148 (1888)

TYPE LOCALITY: "Three Kings Islands."

Specimens: SYNTYPES, Three Kings Islands, T.F.C., Aug 1887, AK 3770, AK 210744 (formerly AK 3770.2), AK 210745-210747 (formerly AK 3770.4-3770.6).

## MYRSINACEAE

***Elingamita johnsonii*** G.T.S. Baylis, *Rec. Auck. Inst. Mus.* 4:100 (1951)

TYPE LOCALITY: "West Island, Three Kings, New Zealand."

Specimen: SYNTYPE, Three Kings Is., no collector (label in Baylis's hand), early Jan 1951, AK 36263.

***Myrsine coxii*** Cockayne, *Trans. Proc. N.Z. Inst.* 34:318 (1902)

TYPE LOCALITY: "Chatham Island."

Specimens: SYNTYPES, \* Chatham Island, F.A.D. Cox, Oct 1900, AK 7077 (ex Herb. L. Cockayne); \* lowland swamp, Chatham Island, F.A.D. Cox, Aug 1891, AK 105670 (ex Herb. L. Cockayne, ex Herb. H.B. Matthews).

***Myrsine kermadecensis*** Cheeseman, *Trans. Proc. N.Z. Inst.* 24:410 (1892)

TYPE LOCALITY: "Sunday Island, Kermadec Group ..."

Specimens: SYNTYPES, Sunday Island, Kermadec Islands, T.F.C., Aug 1887, AK 7064-7065, AK 211644 (formerly AK 7065.2).

***Myrsine neozelandensis*** Colenso, *Trans. Proc. N.Z. Inst.* 22:479 (1890)

TYPE LOCALITY: "Edge of a wood on open plain south of Dannevirke, County of Waipawa, 1889: W.C."

Specimen: ? SYNTYPE, \* near Dannevirke, Hawkes Bay, W. Colenso, no date, AK 7078.

***Myrsine oliveri***  $\equiv$  *Suttonia dentata*

***Myrsine pendulata*** Colenso, *Trans. Proc. N.Z. Inst.* 21:94 (1889)

TYPE LOCALITY: "Woods near River Mangateraa, south of Dannevirke, County of Waipawa, 1888: W.C."

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 7085.

***Suttonia dentata*** W.R.B. Oliv., *Rec. Auck. Inst. Mus.* 3:230 (1948) ≡ ***Myrsine oliveri*** Allan, *Fl. N.Z.* 1:543 (1961)

TYPE LOCALITY: "Type specimen in the Auckland Museum, collected by G.T.S. Baylis on Great Island, Three Kings Islands, December 4th, 1945."

Specimens: SYNTYPES, \* Great Island, Three Kings, G.T.S. Baylis, 4/12/45, AK 22868-22870; PARATYPES, \* Great Is, Three Kings (Tasman Valley), G.T.S. Baylis, 1/12/45, AK 22866-22867; \* Great Is, Three Kings, cliff scree about 800' above sea, G.T.S. Baylis, 5/12/45, AK 22871; Hapuka Pt, NE side, Great Island, Three Kings Islands, E.G. Turbott, 8 May 1946, AK 23006; \* northern cliff face, Great Island, Three Kings Islands, E.G. Turbott, 29 April 1946, AK 23007; north cliff face, Great Island, Three Kings Islands, E.G. Turbott & B. Chaney, 6 May 1946, AK 23008; Great Island, Three Kings, G.T.S. Baylis, 21/2/1934, AK 23047; Great Island, Three Kings, G.T.S. Baylis, 20/2/1934, AK 105686.

## MYRTACEAE

***Leptospermum scoparium*** J.R. et G. Forst. var. ***incanum*** Cockayne, *Trans. Proc. N.Z. Inst.* 49:58 (1917)

TYPE LOCALITY: "North Island: North Auckland Botanical District - common, especially in the northern part of the district, in many places forming thickets. L.C."

Specimen: ? SYNTYPE, near Rangumu [*sic*] Estuary, North Auckland, L.C., no date, AK 5497 (ex Herb. L. Cockayne).

***Leptospermum sinclairii*** Kirk, *Stud. Fl.*:158 (1899)

TYPE LOCALITY: "North Island: Great Barrier Island, Hutton and Kirk. Sea-level to 1,800 ft. Nov to Jan."

Specimen: SYNTYPE, Great Barrier Island, T.K., no date, AK 5515, AK 11437 (ex Herb. T. Kirk).

***Metrosideros colensoi*** Hook.f. var. ***pendens*** Colenso, *Trans. Proc. N.Z. Inst.* 12:360 (1880)

TYPE LOCALITY: "Forests, head of the Manawatu River, climbing lofty trees; 1874-9."

Specimens: ? SYNTYPES, \* Hawkes Bay, W. Colenso, no date, AK 5569-5570.

***Metrosideros fulgens*** Sol. ex Gaertn., *Fruct.* 1:172 (1788)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 102051-102052 (ex BM), AK 184566 (ex BM).

***Metrosideros myrtifolia*** Sol. ex Gaertn., *Fruct.* 1:172 (1788)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 102210-102211 (ex BM), AK 184568 (ex BM), AK 189988 (ex BM).

***Metrosideros subsimilis*** Colenso, *Trans. Proc. N.Z. Inst.* 12:361 (1880)

TYPE LOCALITY: “forests at the head of the Manawatu River, where it climbs lofty trees; 1876-79.”

Specimens: ? SYNTYPE, \* forests at the head of the Manawatu River, W. Colenso, no date, AK 5561; ? SYNTYPES, \* Hawkes Bay, W. Colenso, no date, AK 5562-5563, AK 218790 (formerly AK 5563.2).

*Myrtus bullata* Sol. ex A. Cunn., *Ann. Nat. Hist.* 3:115 (1839)

TYPE LOCALITY: “New Zealand (Northern Island) - 1769, Sir Jos. Banks. Shady woods, Bay of Islands, flowering in December-1826, A. Cunningham - 1834, R. Cunningham.”

Specimens: ? SYNTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 102531-102533 (ex BM), AK 184578 (ex BM).

## ONAGRACEAE

*Epilobium chionanthum* Hausskn., *Öst. bot. Z.* 29:149 (1879)

TYPE LOCALITY: “Had. ad. lacum Takapuna leg. Kirk”

Specimen: ISOLECTOTYPE, Takapuna, no collector (label in Kirk’s hand), no date, AK 11468 (†Raven and Raven 1976:149) (lectotype in K, †Raven and Raven 1976:149).

*Epilobium erebescens* Hausskn. var. *suberecta* Kirk, *Stud. Fl.*: 175 (1899)

TYPE LOCALITY: “Rimutaka Range, T.K.”

Specimen: ISOLECTOTYPE, Rimutaka Range, no collector (label in Kirk’s hand), Jan 1880, AK 5868 (ex Herb. T. Kirk, †Raven and Raven 1976:222), (lectotype in WELT, †Raven and Raven 1976:223).

*Epilobium komarovianum* H. Lev., *Repert. Nov. Sp. Reg. Veg.* 5:98 (1908)

TYPE LOCALITY: “South Island, New Zealand: Preservation Inlet - the Bluff Ngaruawakia mixtum cum nummularifolium et pedunculari - leg. T. Kirk.”

Specimen: HOLOTYPE, The Bluff, no collector (label in Kirk’s hand), no date, AK 28576 (ex Herb. T. Kirk, ex MO, †Raven and Raven 1976:283).

*Epilobium krulleianum* Hausskn., *Monogr. Epil.*:305 (1884)

TYPE LOCALITY: “In Nova-Zelandia leg. Krull. sub E. confertifolia (Hb. Berol.); Canterbury Leg. Haast No. 650 mixt. c. E. pycnostachyo (Hb. Kew); ad Amuri leg. Kirk No. 655 sub E. alsinoidi (Hb. Kew).”

Specimen: ISOLECTOTYPE, St. James Station, Amuri, no collector (label in Kirk’s hand), no date, AK 5833 (ex Herb. T. Kirk, †Raven et Raven 1976:203), (lectotype in K, †Raven and Raven 1976:203).

*Epilobium nummularifolium* R. Cunn. ex A. Cunn., *Ann. Nat. Hist.* 3:31 (1839)

TYPE LOCALITY: “New Zealand (Northern Island) - 1769, Sir Jos. Banks, Shores of the Kerikeri river, & in dry as well as boggy grounds - 1834, Rich. Cunningham.”

Specimens: PARALECTOTYPES, New Zealand, Banks and Solander, 1769-1770, AK 102546-102548 (ex BM), AK 184484 (ex BM), (lectotype in K, †Raven and Raven 1976:279).

*Epilobium nummularifolium* R. Cunn. ex A. Cunn. var. *angustum* Cheeseman, *Man. N.Z. Fl.*:180 (1906)

TYPE LOCALITY: "Cass River, near Lake Tekapo (Canterbury), T.F.C."

Specimens: LECTOTYPE, \* Cass River, near Lake Tekapo, T.F. Cheeseman, Jan 1898, AK 210721 (formerly AK 5765.2, †Raven and Raven 1976:286); ISOLECTOTYPE, Cass River, Lake Tekapo, 3500 ft, T.F.C., Jan 1898, AK 5765 (†Raven and Raven 1976:286).

*Epilobium nummularifolium* R. Cunn. ex A. Cunn. var. *minimum* Kirk, *Stud. Fl.*:174 (1899)

TYPE LOCALITY: "Preservation inlet and the Bluff Hill, T.K."

Specimen: ISOLECTOTYPE, The Bluff, no collector (label in Kirk's hand), no date, AK 28576 (ex Herb. T. Kirk, ex MO, †Raven and Raven 1976:281), (lectotype in WELT, †Raven and Raven 1976:281).

*Epilobium pallidiflorum* Sol. ex A. Cunn., *Ann. Nat. Hist.* 3:34 (1839)

TYPE LOCALITY: "New Zealand (Northern Island). Swampy grounds, Oporaga (Mercury Bay, lat. 36 $\frac{3}{4}$ °S.) - 1769, Sir Jos. Banks. In low wet situations, Wangaroa. - 1826, A. Cunningham."

Specimens: ISOLECTOTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 101102 (ex BM), AK 101106-101109 (ex BM), (lectotype in BM, †Raven and Raven 1976:96).

*Epilobium pedunculare* A. Cunn. var. *brunnescens* Cockayne, *Trans. Proc. N.Z. Inst.* 50:171 (1918)

TYPE LOCALITY: Not stated.

Specimen: LECTOTYPE, from cultivated plant collected on Mount Egmont at about 1200 m, L.C., 2 Jan 1918, AK 5750 (†Raven and Raven 1976:263 as AK 5758 in error).

*Epilobium perplexum* Kirk, *Stud. Fl.*:170 (1899)

TYPE LOCALITY: "North Island: East Cape, J.B. Lee! Ruahine Range, Petrie! Taranaki Range, T.P. Arnold. South Island: Canterbury, Cockayne! Kelly's Creek, Westland, 2,500 ft, Petrie!"

Specimens: LECTOTYPE, \* Ruahine Range, D. Petrie, no date, AK 5706 (†Raven and Raven 1976:175); ISOLECTOTYPE, \* Ruahine Range, D. Petrie, no date, AK 5705.

*Epilobium pictum* Petrie, *Trans. Proc. N.Z. Inst.* 28:583 (1896)

TYPE LOCALITY: "Mountain valleys of Central Otago, from 1500 to 3000 ft; Lowburn Creek; Obelisk Creek; Mount St. Bathans."

Specimen: ISOLECTOTYPE. \* Lowburn Creek, near Cromwell, Otago, D. Petrie, no date, AK 5678 (†Raven and Raven 1976:201), (lectotype in WELT, †Raven and Raven 1976:201).

*Epilobium porphyrium* G. Simpson, *Trans. R. Soc. N.Z.* 75:189 (1945)

TYPE LOCALITY: "... the upper western basin of the Matukituki River, near Hector's Col."

Specimen: ISOLECTOTYPE, \* Hector's Col, G. Simpson, no date, AK 22888 (†Raven and Raven 1976:210), (lectotype in CHR, †Raven and Raven 1976:210).

*Epilobium rostratum* Cheeseman, *Trans. Proc. N.Z. Inst.* 28:534 (1896)

TYPE LOCALITY: "Mountain districts in Canterbury and Otago; apparently not uncommon. Upper Waimakariri, and shingly beds of streams near Lake Tekapo and Lake Pukaki, T.F.C.; near Naseby, Otago, D. Petrie!"

Specimens: LECTOTYPE, Lake Tekapo, Canterbury Alps, alt. 2500 ft, T.F.C., Jan 1883, AK

5818 (†Raven and Raven 1976:247); ISOLECTOTYPE, Lake Tekapo, Canterbury, T.F.C., Jan 1883, AK 5819.

***Epilobium rubromarginatum*** Cockayne, *Trans. Proc. N.Z. Inst.* 48:195 (1916)

TYPE LOCALITY: “South Island: Westland and Canterbury - on consolidated stony debris at from 1,000 m to 1,500 m and upwards on mountains in the neighbourhood of Arthur’s Pass and the Otira Gorge. L.C.”

Specimens: ISOLECTOTYPES, growing on stony debris at foot of precipices of Otira Glacier, 1280 m, L. Cockayne, 25/1/98, AK 5796; growing on stony ground at foot of precipices under the Otira Glacier, 4,000 ft, L.C., 25/1/98, AK 101151 (ex Herb. L. Cockayne, †Raven and Raven 1976:222); Otira Glacier, 1280 m, L. Cockayne, 25/1/98, AK 210719 (ex Herb. L. Cockayne, formerly AK 5796.2, †Raven and Raven 1976:222), (lectotype in WELT, †Raven and Raven 1976:222).

***Epilobium vernicosum*** Cheeseman, *Trans. Proc. N.Z. Inst.* 28:535 (1896)

TYPE LOCALITY: “Mountains of Nelson. Abundant on the Mount Arthur Plateau, 3,000 ft - 4,000 ft alt., and ascending to over 5,000 ft on Mount Arthur and Mount Peel.”

Specimens: SYNTYPES, slopes of Mount Arthur, Nelson, 5000 ft, T.F.C., Jan 1881, AK 5790; Mount Peel, Nelson, 4500 ft, T.F.C., AK 5791, Jan 1886, AK 210722-210723 (formerly AK 5791.2-5791.3).

***Epilobium wilsonii*** Cheeseman var. ***pallidum*** G. Simpson et J.S. Thomson *Trans. R. Soc. N.Z.* 70:30 (1940)

TYPE LOCALITY: “Common on moist limestone in the gorge of the Ure River, Marlborough.”

Specimens: ISOTYPES, \* moist limestone in the gorge of the Ure River, Marlborough, G.S. & J.S.T., no date, AK 70615 (†Raven and Raven 1976:172), AK 101328-101329 (holotype in CHR, †Raven and Raven 1976:172).

## PASSIFLORACEAE

***Passiflora tetrandra*** Sol. ex DC., *Prodr.* 3:323 (1828)

TYPE LOCALITY: “Prope Oruragi ...”

Specimens: ? ISOLECTOTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 102038 (ex BM), AK 189112 (ex BM), (lectotype in BM, †Green 1972:553).

## PIPERACEAE

***Peperomia novae-zelandiae*** Colenso, *Trans. Proc. N.Z. Inst.* 27:394 (1894)

TYPE LOCALITY: “woods near the East Cape; 1894; Mr H. Hill.”

Specimen: ? SYNTYPE, \* woods near the East Cape, H. Hill, no date, AK 3697 (ex Herb. T. Kirk).

***Piper excelsum*** G. Forst. var. ***major*** Cheeseman, *Man. N.Z. Fl.*:595 (1906)

TYPE LOCALITY: “Kermadec Islands: Var. *major* abundant, McGillivray, T.F.C. North Island: Var. *major* plentiful on the Three Kings Islands ...”

Specimens: PARALECTOTYPES, Sunday Island, Kermadec Group, T.F.C., Aug 1887, AK 3692-3695; Three Kings Islands, T.F.C., Nov 1889, AK 3696, AK 214481 (formerly AK 3696.2), AK 218670-218671 (formerly AK 3696.2-3696.3), (lectotype in BM, †Smith 1975).

PITTOSPORACEAE

***Pittosporum anomalum*** Laing et Gourlay, *Trans. R. Soc. N.Z.* 65:55 (1935)

TYPE LOCALITY: "... by the roadside near Jack's Hut (Arthur's Pass) at an altitude of about 850 m."

Specimens: PARATYPES, Hauhungatahi, L.B. Moore and L.M. Cranwell, 9.1.33, AK 101922-101925, AK 101928.

***Pittosporum buchananii*** Hook.f., *Handbk. N.Z. Fl.*:725 (1867)

TYPE LOCALITY: "Northern Island: from near Tongariro (cultivated at Wellington), Buchanan."

Specimen: ? SYNTYPE or ? ISOSYNTYPE, \* Kaitaia, near Mongonui, J. Buchanan, no date, AK 4615.

Note: Protologue locality regarded to be in error (Allan 1961:313).

***Pittosporum crassifolium*** Banks et Sol. ex A. Cunn., *Ann. Nat. Hist.* 4:106 (1840)

TYPE LOCALITY: "New Zealand (Northern Island) - 1769, Sir J. Banks. On Flat Island, one of the Cavallos (*sic*) and at Matauri on the east coast, opposite those islands, &c. - 1833, R. Cunningham."

Specimen: ? SYNTYPE, \* New Zealand, Banks and Solander, 1769-1770, AK 184581 (ex BM).

***Pittosporum crassifolium*** Banks et Sol. ex A. Cunn. var. ***strictum*** Kirk, *Trans. Proc. N.Z. Inst.* 4:266 (1872)

TYPE LOCALITY: "North Island, by the sea, Spirits Bay to Poverty Bay."

Specimen: SYNTYPE, \* Little Barrier Island, T. Kirk, no date, AK 4676.

***Pittosporum dallii*** Cheeseman, *Man. N.Z. Fl.*:1134 (1906)

TYPE LOCALITY: "South Island: Nelson - Mountains near Collingwood, Dall!"

Specimen: SYNTYPE, \* mountains near Collingwood, J. Dall, no date, AK 4702.

***Pittosporum ellipticum*** Kirk var. ***decorum*** Cheeseman, *Man. N.Z. Fl.*:491 (1925)

TYPE LOCALITY: "North Island. Ohinemuri Gorge, T.F.C., Petrie! Gordon Settlement, Downard! Hawai River, inland from Opotiki, F.R. Field! Aorangi Scenic Reserve, V. Sherwood! base of Mount Hikurangi, G.T. Williams!"

Specimens: SYNTYPES, Ohinemuri Gorge near Karangahake, D. Petrie, Nov 1897, AK 4644; Ohinemuri Gorge, near Karangahake, T.F.C., July 1898, AK 4645, AK 210717 (formerly AK 4645.2); Gordon Settlement, near Te Aroha, Downard, no date, AK 4646, AK 209765-209766 (formerly AK 4646.2-4646.3); \* Aorangi Scenic Reserve, near Hikurangi, alt. 3000 ft, V. Sherwood, no date, AK 4647; \* base of Hikurangi, East Cape, G.T. Williams, no date, AK 4648, AK 209767 (formerly AK 4648.2); SYNTYPE, \* Hawai River, inland from Opotiki, F.R. Field, no date, AK 4649.

***Pittosporum ellipticum*** Kirk var. ***ovatum*** Kirk, *Stud. Fl.*:52 (1899)

TYPE LOCALITY: "Whangaroa North, Manaia Hills, western part of the Titirangi district, T.K."

Specimens: ? SYNTYPES, Whangaroa (North), no collector (label in Kirk's hand), no date,



AK 4643 (ex Herb. T. Kirk); Whangaroa North, no collector (label in Kirk's hand), no date, AK 101921 (ex Herb. T. Kirk).

***Pittosporum fairchildii*** Cheeseman, *Trans. Proc. N.Z. Inst.* 20:147 (1888)

TYPE LOCALITY: "Three Kings Islands."

Specimens: SYNTYPES, Three Kings Islands, T.F.C., Aug 1887, AK 4677, AK 210718 (formerly AK 4677.2).

***Pittosporum fasciculatum*** Hook.f., *Fl. N.Z.* 1:24 (1852)

TYPE LOCALITY: "Northern Island, Lake Taupo, Colenso."

Specimen: SYNTYPE or ISOSYNTYPE, \* near Taupo, W. Colenso, no date, AK 4610.

***Pittosporum gilliesianum*** Kirk, *Trans. Proc. N.Z. Inst.* 1:143 (1869)

TYPE LOCALITY: "Mongonui."

Specimen: SYNTYPE, \* Mongonui, T. Kirk, Apr 1868, AK 4696.

***Pittosporum huttonianum*** Kirk, *Trans. Proc. N.Z. Inst.* 2:92 (1870)

TYPE LOCALITY: "On the Great Barrier Island."

Specimens: SYNTYPES, Kaiarara, Great Barrier Island, no collector (label in Kirk's hand), no date, AK 4617 (ex Herb. T. Kirk); Kiwiriki, Great Barrier Island, no collector (label in Kirk's hand), no date, AK 4618 (ex Herb. T. Kirk); Kaiarara, T.K., no date, AK 102250.

***Pittosporum obcordatum*** Raoul. var. *kaitaiaensis* Laing et Gourlay, *Trans. R. Soc. N.Z.* 65:47 (1935)

TYPE LOCALITY: "Kaitaia - Matthews, Carse etc."

Specimens: SYNTYPES or ISOSYNTYPES, \* Lake Tangongue, near Kaitaia, R.H. Matthews, no date, Oct 1901, AK 4624, AK 209170 (formerly AK 4624.2); ? SYNTYPE or ? ISOSYNTYPE, \* Lake Tangongue, near Kaitaia, R.H. Matthews, no date, AK 4622.

***Pittosporum pimeleoides*** R. Cunn. var. *major* Cheeseman, *Man. N.Z. Fl.*:60 (1906)

TYPE LOCALITY: "North Cape, T.F.C."

Specimens: SYNTYPES, North Cape, T.F.C., January 1896, AK 4692, AK 209744-209745 (formerly AK 4692.2-4692.3).

***Pittosporum tenuifolium*** Sol. ex Gaertn., *Fruct.* 1:286 (1788)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 101859-101862 (ex BM), AK 184486 (ex BM).

***Pittosporum turneri*** Petrie in Cheeseman, *Man. N.Z. Fl.*:491 (1925)

TYPE LOCALITY: "Waimarino Plateau, western base of Ruapehu, E. Phillips Turner, H.B. Matthews! H. Carse! Altitudinal range 2000-3500 ft."

Specimens: SYNTYPES, \* Waimarino, H.B. Matthews, 23.1.1921, AK 4654, AK 101959 (ex Herb. H.B. Matthews), AK 101979 (ex Herb. H.B. Matthews), AK 101981-101983 (ex Herb. H.B. Matthews), AK 101986-101987 (ex Herb. H.B. Matthews); \* Waimarino, H.B. Matthews, 21 Dec 1921, AK 4655, AK 101972-101974 (ex Herb. H.B. Matthews), AK 101977 (ex Herb. H.B. Matthews), AK 101988 (ex Herb. H.B. Matthews), AK 209746-

209754 (formerly AK 4655.3-4655.10); \* Waimarino, H.B. Matthews, 22.12.1921, AK 101960 (ex Herb. H.B. Matthews), AK 101975-101976 (ex Herb. H.B. Matthews), AK 101978 (ex Herb. H.B. Matthews), AK 101984-101985 (ex Herb. H.B. Matthews); Waimarino, H.B. Matthews, 26 Nov 1922, AK 70015, AK 101966 (ex Herb. H.B. Matthews).

***Pittosporum umbellatum*** Banks et Sol. ex Gaertn., *Fruct.* 1:286 (1788)

TYPE LOCALITY: Not stated.

Specimen: SYNTYPE, \* New Zealand, Banks and Solander, 1769-1770, AK 184485 (ex BM).

***Pittosporum umbellatum*** Gaertn. var. ***cordatum*** Kirk, *Trans. Proc. N.Z. Inst.* 4:264 (1872)

TYPE LOCALITY: "Great Barrier Island."

Specimens: SYNTYPES, Haratoanga, Great Barrier Island, no collector (label in Kirk's hand), Nov 1867, AK 4684 (ex Herb. T. Kirk); Haratoanga, T.K. no date, AK 102343 (ex Herb. T. Kirk).

***Pittosporum virgatum*** Kirk, *Trans. Proc. N.Z. Inst.* 4:264 (1872)

TYPE LOCALITY: "North Island, Whangaroa North, Great Barrier Island."

Specimens: SYNTYPES, Port Fitzroy, no collector (label in Kirk's hand), no date, AK 4658 (ex Herb. T. Kirk), AK 39403 (ex Herb. T. Kirk, ex MO); Kaiarara, T.K., no date, AK 102314.

## PLANTAGINACEAE

***Plantago lanigera*** Hook.f. var. ***petriei*** Cheeseman, *Man. N.Z. Fl.*:572 (1906)

TYPE LOCALITY: "Mount Kyeburn, alt. 3500 ft, Petrie!"

Specimens: SYNTYPE, \* Mt Kyeburn, Otago, alt. 3500 ft, D. Petrie, no date, AK 8666; ? SYNTYPE, Mt Kyeburn, 4000 ft, no collector (label in Petrie's hand), no date, AK 8665.

***Plantago masoniae*** Cheeseman, *Trans. Proc. N.Z. Inst.* 53:424 (1921)

TYPE LOCALITY: "North Island: Sea-cliffs at Manaia, Taranaki, often in localities well washed with sea spray; Mrs F. Mason!"

Specimen: SYNTYPE, \* seacliffs near Manaia, Mrs Mason, no date, AK 8673.

## POLYGONACEAE

***Muehlenbeckia trilobata*** Colenso, *Trans. Proc. N.Z. Inst.* 21:100 (1888)

TYPE LOCALITY: "In woods south of Dannevirke, County of Waipawa; 1888: W.C."

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, Colenso, no date, AK 3900.

***Rumex neglectus*** Kirk, *Trans. Proc. N.Z. Inst.* 9:493 (1877)

TYPE LOCALITY: "On shingle beaches, Wellington (T.K.), Dusky Bay, (J. Buchanan)."

Specimen: ? SYNTYPE, Wellington, T.K. no date, AK 3891.

## RANUNCULACEAE

***Caltha obtusa*** Cheeseman, *Trans. Proc. N.Z. Inst.* 33:312 (1901)

TYPE LOCALITY: "North Island: Herb. Colenso! ... South Island: Mountains at the head of the Broken River, Canterbury, 5,000-6,000 ft, T.F.C.; Otago - Mount Saint Bathans and

Dunstan Mountains, 5,000-6,000 ft, Petrie!; Black Peak, 6,000 ft, Buchanan!"

Specimens: SYNTYPES, mountains above the Broken River, Canterbury, 5500 ft, T.F.C. Jan 1880, AK 4362, AK 209395 (formerly AK 4362.2); ? SYNTYPE, Black Peak, Otago, 7000 ft, J. Buchanan, no date, AK 4363 (ex WELT).

*Ceratocephalus pungens* Garn.-Jones, *N.Z. J. Bot.* 22:135 (1984)

TYPE LOCALITY: "Bald Hill Flat, 2,000 ft, D. Petrie, Nov 1885."

Specimens: ISOTYPES, Bald Hill Flat, 2000 ft, D. Petrie, Nov 1885, AK 12741; \* Bald Hill Flat, Otago, 2000 ft, D. Petrie, Nov 1885, AK 12742 (†Garnock-Jones 1984:135), (holotype in CHR, †Garnock-Jones 1984:135).

*Clematis australis* Kirk, *Stud. Fl.*:3 (1899)

TYPE LOCALITY: "South Island: Mountain districts, in Nelson and Canterbury, 1,500-3,000 ft. November."

Specimens: SYNTYPES, \* Bealey, Canterbury Alps, alt. 2,000 ft, T. Kirk, no date, AK 4126; \* South Island, Lake Pearson, no collector, no date, AK 28200 (ex Herb. T. Kirk, ex MO).

*Clematis parviflora* A. Cunn. var. *trilobata* Kirk, *Stud. Fl.*:5 (1899)

TYPE LOCALITY: "North Island: Bay of Islands, T. Kirk. South Island: Okarito, A. Hamilton!"

Specimen: SYNTYPE, Bay of Islands, no collector (label in Kirk's hand), no date, AK 11317 (ex Herb. T. Kirk).

*Ranunculus acaulis* Banks et Sol. ex DC., *Reg. Veg. Syst. Nat.* 1:270 (1817)

TYPE LOCALITY: "Novae-Zelandiae prope Opuragi, Banks."

Specimen: ISOTYPE. \* New Zealand, Banks and Solander, 1769-1770, AK 99966, (ex BM, †Garnock-Jones 1990:115), (holotype in BM).

*Ranunculus bergrennii* Petrie, *Trans. Proc. N.Z. Inst.* 19:325 (1887)

TYPE LOCALITY: "Carrick Range, near Cromwell; 4,000 ft: collected November, 1885."

Specimen: ISOLECTOTYPE, \* Carrick Range, Otago, alt. 3500 ft, D. Petrie, no date, AK 4242 (lectotype in WELT, †Fisher 1965:132).

*Ranunculus carsei* Petrie, *Trans. Proc. N.Z. Inst.* 56:11 (1926)

TYPE LOCALITY: "Mount Tongariro, near the base, H. Carse!"

Specimen: ISOLECTOTYPE, Sulphur Creek, Mount Tongariro, H. Carse, 1.1.24, AK 99969 (†Garnock-Jones 1990:116), (lectotype in CHR, †Garnock-Jones 1990:116).

*Ranunculus cheesemanii* Kirk, *Stud. Fl.*:17 (1899)

TYPE LOCALITY: "South Island: Near Fowler's Pass, &c., in places where water has stagnated. 3,000 ft. T.K."

Specimen: ISOTYPE, \* Fowler's Pass, Nelson, 3000 ft, T. Kirk, no date, AK 4306 (†Garnock-Jones 1990:116), (holotype in WELT).

*Ranunculus depressus* Kirk var. *glabratus* Kirk, *Stud. Fl.*:17 (1899)

TYPE LOCALITY: "Otago: Mount Cardrona, 4000 ft. Petrie!"

Specimen: ISOTYPE, Mount Cardrona in water runnels, 4000 ft, D.P., no date, AK 4313 (ex Herb. D. Petrie, †Garnock-Jones 1990:118), (holotype in WELT).

***Ranunculus depressus*** Kirk var. ***stewartiae*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:155 (1943)  $\equiv$  ***R. simulans*** Garn.-Jones in Connor and Edgar, *N.Z. J. Bot.* 25:126 (1987)  
TYPE LOCALITY: "... the banks of Freshwater River, Stewart Island."

Specimens: ISOTYPES, \* damp banks at Freshwater River, Stewart Island, G. Simpson, Mar 1941, AK 22897 ( $\dagger$ Garnock-Jones in Connor and Edgar 1987:126); \* Stewart Island, G. Simpson, no date, AK 22910 ( $\dagger$ Garnock-Jones in Connor and Edgar 1987:126), (holotype in CHR,  $\dagger$ Garnock-Jones in Connor and Edgar 1987:126).

***Ranunculus grahamii*** Petrie, *Trans. Proc. N.Z. Inst.* 46:32 (1914)

TYPE LOCALITY: "Rocks of 'Aiguille Roque', a peak south of Malte Brun, Mount Cook district, 9000 ft; Coronet Peak, Mt Cook District."

Specimen: ISOLECTOTYPE, \* Coronet Peak, Mt Cook District, P. Graham, 1910, AK 4214 (lectotype in WELT,  $\dagger$ Fisher 1965:144).

***Ranunculus hirtus*** Banks et Sol. ex DC. var. ***elongatus*** Cheeseman, *Man. N.Z. Fl.*:19 (1906)  
TYPE LOCALITY: "Lowland districts north of Auckland."

Specimens: LECTOTYPE, Little Barrier Island, T.F.C., Jan 1901, AK 4269 ( $\dagger$ Cooper 1949:401,  $\dagger$ Garnock-Jones 1990:120); PARALECTOTYPE, Parerau, Doubtless Bay, T.F.C. Jan 1896, AK 4268.

***Ranunculus hirtus*** Banks et Sol. ex DC. var. ***gracilis*** Cheeseman, *Man. N.Z. Fl.*:19 (1906)  $\equiv$  ***R. mirus*** Garn.-Jones in Connor and Edgar, *N.Z. J. Bot.* 25:126 (1987)

TYPE LOCALITY: "Mountain districts of the South Island, 3000-4500 ft."

Specimens: LECTOTYPE, Mount Arthur Plateau, Nelson, T.F.C., Jan 1886, AK 4276 ( $\dagger$ Garnock-Jones in Connor and Edgar 1987:126); ISOLECTOTYPE, Mount Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 4275.

***Ranunculus insignis*** Hook.f. var. ***lobulatus*** Kirk, *Stud. Fl.*:8 (1899)

TYPE LOCALITY: "Marlborough: Kowhai River, 500 ft. Mount Fyffe, 3,000 ft. T.K. Oct, Nov."

Specimen: ISOLECTOTYPE, \* Mount Fyffe, Marlborough, 3,000 ft, T. Kirk, no date, AK 4192 (lectotype in WELT,  $\dagger$ Fisher 1965:150).

***Ranunculus limosella*** F. Muell. ex Kirk, *Trans. Proc. N.Z. Inst.* 3:177 (1871)

TYPE LOCALITY: "In the Whangape, Waikare, and Waihi lakes, Waikato, T.K."

Specimens: PARATYPES, Lake Whangape, no collector (label in Kirk's hand), no date, AK 11326 (ex Herb. T. Kirk); Lake Whangape, T.K., May 1870, AK 11327 (ex Herb. T. Kirk), (holotype in K,  $\dagger$ Garnock-Jones 1990:118).

***Ranunculus matthewsii*** Cheeseman, *Man. N.Z. Fl.*:1133 (1906)

TYPE LOCALITY: "South Island: Otago-Mount Earnslaw, alt. 4000-6000 ft, H.J. Matthews!"

Specimen: LECTOTYPE, \* Mount Earnslaw, Otago, 4500 ft, H.J. Matthews, no date, AK 4174 ( $\dagger$ Fisher 1965:121).

***Ranunculus mirus***  $\equiv$  ***Ranunculus hirtus*** var. ***gracilis***

***Ranunculus muricatus*** Colenso, *Trans. Proc. N.Z. Inst.* 23:381 (1890)

TYPE LOCALITY: "High, dry, open plains, Tahoraiti, south of Dannevirke, County of Waipawa ... 1885-1890: W.C."

Specimen: ISOLECTOTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 4285 (†Garnock-Jones 1990:118), (lectotype in WELT, †Garnock-Jones 1990:118).

***Ranunculus novae-zelandiae*** Petrie, *Trans. Proc. N.Z. Inst.* 26:266 (1894)

TYPE LOCALITY: "Rough shingly stations at the summit of the Rock and Pillar Range, opposite Middlemarch, and similar stations on the Old Man Range, at 4,000 ft and upwards."

Specimens: ISOLECTOTYPES, Rock and Pillar Mountains, 4000 ft, D. Petrie, Nov 1892, AK 4243; Rock and Pillar, Otago, 4300 ft, no collector (label in Petrie's hand), Nov 1892, AK 4245 (lectotype in WELT, †Fisher 1965:132).

***Ranunculus novae-zelandiae*** Petrie var. *repens* G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:21 (1942)

TYPE LOCALITY: "Debris at Blue Lake, Garvie Mts., 1230 m altitude."

Specimen: ISOTYPE, \* debris at Blue Lake, Garvie Mts., 1230 m, Simpson and Thomson, no date, AK 99961 (holotype in CHR, †Fisher 1965:132).

***Ranunculus porrectus*** G. Simpson, *Trans. R. Soc. N.Z.* 75:187 (1945)

TYPE LOCALITY: "... Hope River Valley, west of Hanmer."

Specimen: LECTOTYPE, \* Hope River Valley, G. Simpson, no date, AK 22889 (†Garnock-Jones 1990:117).

***Ranunculus reflexus*** Garn.-Jones in Connor and Edgar, *N.Z. J. Bot.* 25:126 (1987)

TYPE LOCALITY: "Hab. in graminosis Novae Zelandiae. Prope Tigadu, Tolaga, Opuragi, Totaranui, Banks ..."

Specimens: ? ISOLECTOTYPES, \* New Zealand, Banks and Solander, 1769-1770, AK 50925 (ex BM), AK 99942 (ex BM), AK 99943 (ex BM, †Garnock-Jones 1990:120), (lectotype in G, †Garnock-Jones 1990:119).

***Ranunculus simulans*** ≡ *R. depressus* var. *stewartiae*

***Ranunculus tenuicaulis*** Cheeseman, *Trans. Proc. N.Z. Inst.* 17:235 (1885)

TYPE LOCALITY: "Canterbury Mountains above Arthur's Pass, altitude 4,000-5,000 ft. T.F.C."

Specimen: SYNTYPE, mountains above Arthur's Pass, alt. 4500 ft, T.F.C., no date, AK 4232.

***Ranunculus urvilleanus*** Cheeseman, *Man. N.Z. Fl.*:446 (1925)

TYPE LOCALITY: "North Island: North Cape Peninsula, not uncommon in marshy places, T.F.C., H. Carse!; low grounds by Whangaroa Harbour, T.F.C.; Bay of Islands, abundant on the shores, D'Urville (1828); Little Barrier Island, T.F.C."

Specimens: LECTOTYPE, \* near Kaitaia, H. Carse, Dec 1920, AK 12415 (†Garnock-Jones 1990:120); PARALECTOTYPES, Parerau, Doubtless Bay, T.F.C., Jan 1896, AK 4268; Little Barrier Island, T.F.C., Jan 1901, AK 4269; \* Fairburn, Mangonui Co., H. Carse, Jan 1907, AK 4270, AK 212968 (formerly numbered 4270.2); Flat Bush, Mangonui County, H. Carse, 11 Oct 1920, AK 12413 (ex Herb. H. Carse), AK 12414.

## RHAMNACEAE

***Pomaderris hamiltonii*** L.B. Moore in Allan, *Fl. N.Z.* 1:420 (1961)

TYPE LOCALITY: "Warkworth."

Specimens: ISOTYPE, seedling from Neville St, Warkworth, North Auckland, grown in garden of Dr. W.H. Hamilton, 4 Fitzroy St, Wadestown, Wellington, L.B. Moore, 7.10.1955, AK 71699; PARATYPE, garden, 4 Fitzroy St, Wadestown, Wellington, ex Neville St, Warkworth, North Auckland, L.B. Moore, 19.1.56, AK 71700 (holotype in CHR, †Moore in Allan 1961:420).

***Pomaderris mollis*** Colenso, *Trans. Proc. N.Z. Inst.* 25:327 (1893)

TYPE LOCALITY: "Dry hills near Puketapu, west of Napier, Hawke's Bay; rare; 1890-92; flowering 10th November; W.C."

Specimen: ? SYNTYPE, \* Puketapu, Napier, W. Colenso, no date, AK 5136.

***Pomaderris rugosa*** Cheeseman, *Man. N.Z. Fl.*:554 (1925)

TYPE LOCALITY: "North Island: Whangarei heads, summit of Mount Manaia, T. Kirk! T.F.C., Cape Colville and Coromandel to Tapu Creek (Hastings); upper part of the Kaueranga Valley, Thames, T.F.C., Adams! W. Townson! Mercury Bay, T. Kirk!"

Specimens: SYNTYPES, Puru Creek, Thames, T.F.C., Nov 1874, AK 5137; summit of Mt Manaia, Whangarei, T.F.C., August 1878, AK 5138; Coromandel Harbour, T.F.C., no date, AK 5139; \* Tapu Creek, Thames, W. Townson, Nov 1918, AK 5140, AK 209775 (formerly AK 5140).

***Pomaderris tainui*** Hector, *Trans. Proc. N.Z. Inst.* 11:429 (1879)

TYPE LOCALITY: "Sea Coast, south of Mokau River, in flower 5th December 1878."

Specimen: HOLOTYPE, Mokau, J. Hector, no date, AK 5135 (confirmed N. G. Walsh, 18 viii 1993).

## ROSACEAE

***Acaena juvenca*** B.H. Macmill., *N.Z. J. Bot.* 27:109 (1989)

TYPE LOCALITY: "New Zealand, Otago, Karoro Creek south of Willsher Bay Reserve, 46°25' E lat. 169°46' S long ... 100 m alt. B.H. Macmillan 85/37, 12 Feb 1985, CHR 316173."

Specimen: ISOTYPE, above Karoro Creek, south of Willsher Bay Reserve, Otago, 100 m, NZMS 260 H46:612172 steep hillside scrub marginal to broadleaf/podocarp forest remnant. Under thicket of C. p. with canopy 50 m high. B.H. Macmillan 85/37, 12 Feb 1985, AK 176854 (†Macmillan 1989:109, ex CHR), (holotype in CHR, †Macmillan 1989:109).

***Acaena micrantha*** Colenso, *Trans. Proc. N.Z. Inst.* 23:383 (1891)

TYPE LOCALITY: "On open plains, Tahoraiti, south of Dannevirke, County of Waipawa; 1886-1890, W.C."

Specimens: ? SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 4779, AK 209573 (formerly AK 4779.2).

***Acaena rorida*** B.H. Macmill., *N.Z. J. Bot.* 29:131 (1991)

TYPE LOCALITY: "New Zealand NW Ruahine Range, west of Makirikiri tarns, 30°37' S alt., 176°09' E long., turf knoll in limestone ravine, 3700 ft, B.H. Macmillan 81/32, 10 Feb

1981, CHR 363290.”

Specimen: ISOTYPE, cultivated, ex N.W. Ruahine Range, west of Makirikiri tarns, B.H. Macmillan, 19 January 1990, AK 189547 (holotype in CHR, †Macmillan 1991:131).

*Acaena sanguisorbae* Vahl subsp. *profundeincisa* Bitter var. *diminuta* Bitter, *Repert nov. Spec. Regn. veg.* 10:496 (1912)

TYPE LOCALITY: “Novae-Zelandiae insula meridionalis Fell-field, east face of Mt Torlesse range, Canterbury, alt. 100 m L. Cockayne no. 628, 30.XII.1902 [should be 1901, B.H. Macmillan pers. comm., 1994], in statu florente sub nom A. (adscendens Vahl) ? herb. Upsal!” Specimen: ISOTYPE, Mt Torlesse, Staircase Spur, alt 1000 m, no collector (label in Cockayne’s hand), 30 XII 1901, AK 103084 (ex Herb. L. Cockayne), (holotype in UPS).

*Geum divergens* Cheeseman, *Trans. Proc. N.Z. Inst.* 48:210 (1916)

TYPE LOCALITY: “South Island: Sheltered places among rocks on the slopes of Mount Captain, Clarence Valley, alt. 5,000 ft, T.F.C.”

Specimens: LECTOTYPE, Mount Captain, Hanmer, alt. 5000 ft, T.F.C., Jan 1893, AK 4760 (†Molloy and Webb 1994:426); ISOLECTOTYPE, AK 209317 (†Molloy and Webb 1994:426).

## RUBIACEAE

*Asperula aristifera* Colenso, *Trans. Proc. N.Z. Inst.* 21:88 (1889)

TYPE LOCALITY: “Open grassy plains, Tahoraiti, south of Dannevirke, County of Waipawa; 1887, flowering in November. W.C.”

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 9175.

*Coprosma alba* Colenso, *Trans. Proc. N.Z. Inst.* 24:388 (1892)

TYPE LOCALITY: “On the eastern banks of the River Manawatu, near the new bridge, road from Dannevirke to Wainui, County of Waipawa, forming thickets; 1891: W.C.”

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8978.

*Coprosma areolata* Cheeseman, *Trans. Proc. N.Z. Inst.* 18:315 (1886)

TYPE LOCALITY: “North Island: common in Auckland province, and probably in most lowland districts. South Island: Nelson, T.F.C., Otago, D. Petrie.”

Specimens: SYNTYPES, Lake Takapuna, near Auckland, T.F.C., Sep 1881, AK 8778; Mercer, Waikato River, T.F.C., Sep 1877, AK 8780; Mercer, Waikato River, T.F.C., Sept 1881, AK 8781; Mercer, Waikato River, T.F.C., Sep 1884, AK 8782-8783; \* vicinity of Dunedin, Otago, D. Petrie, no date, AK 8785, AK 211647 (formerly AK 8785); ? SYNTYPES, Hunua, near Auckland, T.F.C., no date, AK 8774-8777.

*Coprosma aurantiaca* Colenso, *Trans. Proc. N.Z. Inst.* 22:464 (1890)

TYPE LOCALITY: “On low flats, sides of streams, open lands south of Dannevirke, County of Waipawa; 1886-89: W.C. Forming dense impenetrable thickets; also, but more sparingly, in similar localities near Norsewood; 1884: W.C.”

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8907.

*Coprosma autumnalis* Colenso, *Trans. Proc. N.Z. Inst.* 19:263 (1887)

TYPE LOCALITY: “Forests near Norsewood, County of Waipawa; 1881-6: W.C.”

Specimen: ? SYNTYPE, \* Norsewood, Hawkes Bay, W. Colenso, May 1886, AK 8689.

*Coprosma buehneri* Kirk, *Trans. Proc. N.Z. Inst.* 24:424 (1891)

TYPE LOCALITY: "North Island: Near Cape Terawhiti."

Specimen: SYNTYPE, rocky nook near Cape Terawhiti, T. Kirk, Oct 15 1883, AK 8878.

*Coprosma chathamica* Cockayne, *Trans. Proc. N.Z. Inst.* 34:317 (1902)

TYPE LOCALITY: "Chatham Islands."

Specimens: SYNTYPES, Whangamarino, Chatham Island, Cox & Cockayne, Feb 1901, AK 8717 (ex Herb. L. Cockayne); Chatham Island, Cockayne and Cox, Feb 1901, AK 37336 (ex Herb. L. Cockayne).

*Coprosma cheesemanii* W.R.B. Oliv., *Bull. Bishop Mus., Honolulu* 132:46 (1935)

TYPE LOCALITY: "... tussock grassland, open low scrub, bog & beech forest, altitude 2000-5000 ft ..."

Specimens: PARATYPES, Rangipo Plain, D.P., 3000 ft, no date, AK 9088 (ex Herb. D. Petrie); \* Boundary Peak, Lyell District, 4000 ft, W. Townson, no date, AK 9089, AK 211967 (formerly AK 8089.2); Mt Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jany 1886, AK 9090-9095; Mt Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jan 1881, AK 9096; Mount Arthur Plateau, Nelson, alt. 4500 ft, T.F.C., Jan 1881, AK 9097.

*Coprosma coffaeoides* Colenso, *Trans. Proc. N.Z. Inst.* 21:87 (1889)

TYPE LOCALITY: "Edges of woods and margins of streamlets south of Dannevirke, County of Waipawa, 1888: W.C."

Specimens: ? SYNTYPES, Hawkes Bay, Rev. W. Colenso, no date, AK 8726-8728.

*Coprosma concinna* Colenso, *Trans. Proc. N.Z. Inst.* 16:330 (1884)

TYPE LOCALITY: "Dry woods between Norsewood and Dannevirke [*sic*], Waipawa County, where it is plentiful, 1876-1883: W.C."

Specimens: ? SYNTYPES, \* no locality, W. Colenso, no date, AK 8803, AK 209495 (formerly AK 8803.2).

*Coprosma crenulata* W.R.B. Oliv., *Trans. Proc. N.Z. Inst.* 49:153 (1917)

TYPE LOCALITY: "Clinton Saddle, Lake Te Anau (3,000 ft) and Kelly's Hill, Otira River, Westland (3,500 ft)."

Specimen: SYNTYPE or ISOSYNTYPE, Kelly's Hill, 3800 ft, D.P., Jany 1893, AK 9039.

*Coprosma dodonaefolia* W.R.B. Oliv., *Bull. Bishop Mus., Honolulu* 132:127 (1935)

TYPE LOCALITY: "New Zealand, Great Barrier Id., Mount Hobson, January 1929, Oliver, Dominion Mus., type."

Specimen: SYNTYPE, \* Mt Hobson, Gt. Barrier Island, W.R.B. Oliver, Jan 11, 1929, AK 37296 (ex WELT).

*Coprosma heterophylla* Colenso, *Trans. Proc. N.Z. Inst.* 18:263 (1886)

TYPE LOCALITY: "In thick, dry woods near Norsewood, County of Waipawa; 1885: W.C."

Specimens: ? SYNTYPES, \* North Island, W. Colenso, no date, AK 8817, AK 209496 (formerly AK 8817.2).

*Coprosma intertexta* G. Simpson, *Trans. R. Soc. N.Z.* 75:194 (1945)

TYPE LOCALITY: "... the Swineburn Valley, near Kyebrun, Central Otago."



Specimens: SYNTYPES, \* Swineburn Valley, Central Otago, G. Simpson, no date, AK 22885, AK 211649 (formerly AK 22885b).

*Coprosma kirkii* Cheeseman, *Trans. Proc. N.Z. Inst.* 29:391 (1897)

TYPE LOCALITY: "North Cape peninsula; Tapotopoto Bay: T. Kirk! Near Whangakea, and coast between Tom Bowline's [Bowling] Bay and Hooper's Point: T.F.C. Near Ahipara: T.F.C." Specimens: SYNTYPES, Tapotopoto Bay, North Cape Peninsula, T. Kirk, Apr 1867, AK 8988; Tom Bowline's [Bowling] Bay, North Cape; T.F.C., Jan 1896, AK 8989-8991; Ahipara, T.F.C., Jan 1896, AK 8996.

*Coprosma lentissima* Colenso, *Trans. Proc. N.Z. Inst.* 22:465 (1890)

TYPE LOCALITY: "Outer edges of woods, open plains south of Dannevirke, County of Waipawa; 1889: W.C."

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8908.

*Coprosma lucida* J.R. et G. Forst. var. *angustifolia* Cheeseman, *Man. N.Z. Fl.*:859 (1925)

TYPE LOCALITY: "Little Barrier Island, T.F.C.; Cape Colville Peninsula, from Mochau to Te Aroha, T. Kirk! Adams! W. Townson! T.F.C.; Mount Egmont, T.F.C., Cockayne. Sea level to 3500 ft. September-November."

Specimens: SYNTYPES, \* Thames, J. Adams, no date, AK 8699; \* Upper Kaueranga, Thames, W. Townson, no date, AK 8700; \* Thames, Upper Kaueranga, W. Townson, no date, AK 8701; Upper Kaueranga Valley, W. Townson, Oct 1920, AK 8702; Look-out Rocks, Thames, 2000 ft, W. Townson, no date, AK 8703-8704; \* Tairua, J. Adams, no date, AK 8705.

*Coprosma lucida* J.R. et G. Forst. var. *obovata* Kirk, *Stud. Fl.*:231 (1899)

TYPE LOCALITY: "Great Barrier Island and Cape Colville ranges. Sep to Nov."

Specimen: SYNTYPE, \* Great Barrier Island, T. Kirk, no date, AK 8693.

*Coprosma macrocarpa* Cheeseman, *Trans. Proc. N.Z. Inst.* 20:147 (1888)

TYPE LOCALITY: "Three Kings Islands."

Specimens: SYNTYPES, Three Kings Islands, T.F.C., Aug 1887, AK 8681-8682, AK 212410 (formerly AK 8682.2).

*Coprosma margarita* Colenso, *Trans. Proc. N.Z. Inst.* 28:594 (1896)

TYPE LOCALITY: "Ruahine Mountain Range, east side: Mr A. Olsen; 1895."

Specimen: ? SYNTYPE, \* Ruahine Mountain Range, east side, Olsen, no date, AK 9069.

*Coprosma multiflora* Colenso, *Trans. Proc. N.Z. Inst.* 21:86 (1889)

TYPE LOCALITY: "Low woods south of Dannevirke, County of Waipawa; flowering November, fruiting April, 1887-88: W.C."

Specimens: ? SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8784, AK 211648 (formerly AK 8784.2).

*Coprosma neglecta* Cheeseman, *Trans. Proc. N.Z. Inst.* 44:160 (1912)

TYPE LOCALITY: "North Island: On the faces of cliffs near the North Cape, January 1896. T.F.C."

Specimens: SYNTYPES, cliffs at the North Cape, T.F.C., Jan 1896, AK 8823 (Fig. 5), AK 8824-8825.

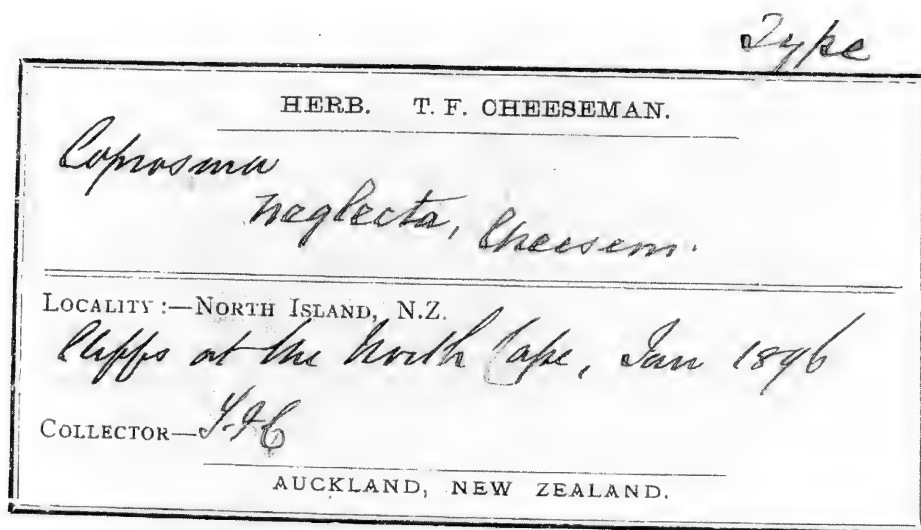


Fig. 5. Herbarium label of T.F. Cheeseman, 1896 (AK 8823), syntype of *Coprosma neglecta* (13 x 7.5 cm).

***Coprosma obconica*** Kirk, *Stud. Fl.*:237 (1899)

TYPE LOCALITY: "South Island: Nelson: Wairoa Gorge, Bryant and Kirk. Aug."

Specimens: ? SYNTYPES or ? ISOSYNTYPES, \* Wairoa Gorge, Nelson, D. Bryant, no date, AK 8918-8919.

***Coprosma orbiculata*** Colenso, *Trans. Proc. N.Z. Inst.* 22:465 (1890)

TYPE LOCALITY: "Shaded forests south of Dannevirke, County of Waipawa; 1889: W.C."

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8804.

***Coprosma parviflora*** Hook.f. var. ***dumosa*** Cheeseman, *Man. N.Z. Fl.*:254 (1906)

TYPE LOCALITY: "North and South Islands, Stewart Island, Auckland and Campbell Islands: Abundant throughout, ascending to over 4000 ft. October-January."

Specimens: SYNTYPES, Mount Arthur Plateau, Nelson, T.F.C., Jan 1886, AK 8864, AK 8866; \* Wooded Peak, F.G. Gibbs, no date, AK 8865; Red Hills Wairau Valley, alt. 2500 ft, T.F.C., Jan 1882, AK 8867-8868.

***Coprosma parviflora*** Hook.f. var. ***pilosa*** Cheeseman, *Trans. Proc. N.Z. Inst.* 19:242 (1887)

TYPE LOCALITY: "Common in many places on the mountains of Nelson and Canterbury."

Specimens: SYNTYPES, Mount Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 8828-8830; Arthur's Pass, Canterbury Alps, 3000 ft, T.F.C., Jan 1883, AK 8831.

***Coprosma pendula*** Colenso, *Trans. Proc. N.Z. Inst.* 21:84 (1889)

TYPE LOCALITY: "Dry woods south of Dannevirke, County of Waipawa; flowering

October, fruiting April, 1887 and 1888: W.C.”

Specimens: ? SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8888-8889.

***Coprosma petriei*** Cheeseman, *Trans. Proc. N.Z. Inst.* 18:316 (1886)

TYPE LOCALITY: “South Island, mountains near Lake Tekapo, Canterbury, altitude 4,000 ft; T.F.C. Uplands in the interior of Otago, common; D. Petrie!

Specimens: SYNTYPES, \* Mt St Bathans, D. Petrie, no date, AK 9123; \* Cromwell, Otago, 700 ft, D. Petrie, no date, AK 9124; Maniototo Plain, D. Petrie, no date, AK 9128; ? SYNTYPES, \* Otago, D. Petrie, no date, AK 9126-9127; no locality, no collector (label in Petrie’s hand), no date, AK 9129.

***Coprosma ramulosa*** Petrie, *Trans. Proc. N.Z. Inst.* 27:406 (1895)

TYPE LOCALITY: “Arthur’s Pass (3,000 ft), and Kelly’s Hill (2,500 ft to 3,500 ft) both in Westland.”

Specimen: SYNTYPE or ISOSYNTYPE, Kellys Hill, 2300 ft, L.C., Feb 1896, AK 8871.

***Coprosma rhamnoides*** A. Cunn. var. ***divaricata*** Cheeseman, *Trans. Proc. N.Z. Inst.* 19:240 (1887)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, Northcote, near Auckland, T.F.C., Sep 1884, AK 8805; Northcote, near Auckland, T.F.C., Aug 1884, AK 8806-8807, AK 211653 (formerly AK 8806.2), AK 211654-211655 (formerly AK 8807.2-8807.3); ? SYNTYPES, Chelsea, near Auckland, T.F.C., no date, AK 8808-8812, AK 211656 (formerly AK 8809.2).

***Coprosma rigida*** Cheeseman, *Trans. Proc. N.Z. Inst.* 19:243 (1887)

TYPE LOCALITY: “North and South Islands - Not uncommon throughout, in swampy forests.”

Specimens: SYNTYPES, Mercer, Waikato, T.F.C. Sep 1884, AK 8900-8902, AK 212411 (formerly AK 8902.2); Mercer, Waikato River, T.F.C., Sep 1881, AK 8903-AK 8904.

***Coprosma rubra*** Petrie, *Trans. Proc. N.Z. Inst.* 17:269 (1885)

TYPE LOCALITY: “Dunedin, mostly in woods.”

Specimens: ? SYNTYPES, \* vicinity of Dunedin, Otago, D. Petrie, no date, AK 8921-8930, AK 211963 (formerly AK 8926.2).

***Coprosma rufescens*** Colenso, *Trans. Proc. N.Z. Inst.* 18:261 (1886)

TYPE LOCALITY: “Scattered on margins of low forests, near Norsewood, County of Waipawa; 1874-85: W.C.”

Specimen: ? SYNTYPE, \* Hawkes Bay, W. Colenso, no date, AK 8768.

***Coprosma rugosa*** Cheeseman, *Man. N.Z. Fl.*:1141 (1906)

TYPE LOCALITY: “South Island: Nelson - Buller Gorge. W. Townson! Clarence Valley, T.F.C. Canterbury - Arthur’s Pass and Mount Cook district, T.F.C. Otago - Near Dunedin, Petrie! Sea-level to 3000 ft.”

Specimens: SYNTYPES, \* Buller Gorge, near Westport, W. Townson, AK 8960-8963; Clarence Valley, 3500 ft, T.F.C., Jan 1883, AK 8964; Arthur’s Pass, Canterbury Alps, 3000 ft, T.F.C., Jan 1880, AK 8965; Hermitage, Mt Cook, 2500 ft, T.F.C., Jan 1898, AK 8966-8967; \* vicinity of Dunedin, Otago, alt. 1500 ft, D. Petrie, no date, AK 8968-8971.

*Coprosma tenuicaulis* Hook.f. var. **major** Cheeseman, *Man. N.Z. Fl.*:252 (1906)

TYPE LOCALITY: "Lower Waikato, H. Carse!"

Specimen: SYNTYPE, Lower Waikato, H.C., 12 Oct 1901, AK 8788.

*Coprosma tenuifolia* Cheeseman, *Trans. Proc. N.Z. Inst.* 18:315 (1886)

TYPE LOCALITY: "Ruahine Mountains; Colenso ... Pirongia Mountain, Mount Karioi; abundant on the Mount Egmont Ranges, T.F.C ... collected by Mr Kirk between Upper Wanganui and the Waikato ..."

Specimens: SYNTYPES, \* no locality, W. Colenso, no date, AK 8743; \* near base of Ruapehu, T. Kirk, no date, AK 8745; Mount Egmont Ranges, T.F.C., Jan 1885, AK 8746; Stratford, Taranaki, T.F.C., January 1885, AK 8747; Pirongia Mountain, Waikato, T.F.C., no date, AK 8748.

*Coprosma turbinata* Colenso, *Trans. Proc. N.Z. Inst.* 24:389 (1892)

TYPE LOCALITY: "Sides of streamlets, edges of woods, south of Dannevirke, County of Waipawa; 1890-91: W.C."

Specimens: ? SYNTYPES, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 8905-8906, AK 209497 (formerly AK 8905.2).

*Coprosma virescens* Petrie, *Trans. Proc. N.Z. Inst.* 11:426 (1879)

TYPE LOCALITY: "Dunedin, Water of Leith, Vauxhall, Saddle Hill, where it was first gathered by Mr A.C. Purdie."

Specimens: ? SYNTYPES, \* Dunedin, D. Petrie, no date, AK 8933-8937, AK 211964 (formerly AK 8936).

*Coprosma waima* A.P. Druce, *N.Z. J. Bot.* 27:119 (1989)

TYPE LOCALITY: "Holotypus, Mt Hautura, Waima Forest, Northland, 2100 ft, rock face, SW facing, L.J. Forester and J.G. Beachman, 17 April 1986, CHR 394507."

Specimens: ISOTYPES, \* NZ, NI, Hokianga Co., Waima State Forest: below Hauturu Trig, L.J. Forester & J.G. Beachman, 17 April 1986, AK 176710-176711 (holotype in CHR, †Druce 1989:119).

*Coprosma wallii* Petrie ex Cheeseman, *Man. N.Z. Fl.*:867 (1925)

TYPE LOCALITY: "South Island: Canterbury - Poulter River, Upper Waimakariri, Peel Forest, A. Wall! 1800-2500 ft. November-December."

Specimen: SYNTYPE, \* Upper Poulter River, Waimakiriri Basin, A. Wall, no date, AK 8880.

*Galium erythrocaulon* Colenso, *Trans. Proc. N.Z. Inst.* 16:332 (1884)

TYPE LOCALITY: "Stony declivities, skirts of dry woods between Norsewood and Dannevirke (*sic*), Waipawa County, 1879-1882: W.C."

Specimen: ? SYNTYPE, \* Dannevirke, Hawkes Bay, W. Colenso, no date, AK 9168.

*Galium trilobum* Colenso, *Trans. Proc. N.Z. Inst.* 20:192 (1887)

TYPE LOCALITY: "Edge of streamlets in dense shaded woods near Dannevirke (*sic*), County of Waipawa; 1887; W.C."

Specimen: ? SYNTYPE, \* Hawkes Bay, W. Colenso, no date, AK 9165.

*Nertera ciliata* Kirk, *Stud. Fl.*:247 (1899)

TYPE LOCALITY: "South Island: Bealey Gorge, 2,000 ft, Jan 1876. Enys and Kirk."  
Specimen: SYNTYPE, \* Bealey, Canterbury Alps, T. Kirk, no date, AK 9153.

## SAPINDACEAE

*Alectryon excelsus* Gaertn. var. *grandis* Cheeseman, *Trans. Proc. N.Z. Inst.* 24:409 (1892)

TYPE LOCALITY: "Cliffs on the north side of the Three Kings Islands; a single small clump alone seen. T.F.C."

Specimens: SYNTYPES, Three Kings Islands, T.F.C., November 1889, AK 5125, AK 210755-210756 (formerly AK 5125.2-5125.3).

## SCROPHULARIACEAE

*Calceolaria (Jovellana) sturmii* Colenso, *Trans. Proc. N.Z. Inst.* 27:392 (1895)

TYPE LOCALITY: "On the west side of the Kaweka mountain range, near Napier; 1893-94: Mr W.F.C. Sturm."

Specimen: ? SYNTYPE, \* Kaweka Mountains, Hawkes Bay, Sturm, no date, AK 7604.

*Euphrasia cheesemanii* Wettst., *Öst. bot. Z.*:381 (1900)

TYPE LOCALITY: "New Zealand. South Island: Mt Arthur Plateau, Nelson, alt. 4000 ft - Mt Owen, Nelson, 4000 ft - leg. T.F. Cheeseman."

Specimens: ISOSYNTYPES, Mount Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 8578; Mount Owen, Nelson, alt. 4000 ft, T.F.C., Jan 1882, AK 8579.

*Euphrasia dyeri* Wettst., *Mon. Gatt. Euphr.*:267 (1896)

TYPE LOCALITY: "Neu-Seeland. Mt Kyeburn, Otago, (lg. Pelise)."

Specimen: ISOSYNTYPE, \* Mt Kyeburn, Otago, 4500 ft, D. Petrie, no date, AK 8586.

*Euphrasia integrifolia* Petrie, *Trans. Proc. N.Z. Inst.* 47:53 (1915)

TYPE LOCALITY: "Wet alpine meadow and bogs on Mount Cleughern, Fiord County, Southland, about 5,000 ft; J. Crosby Smith!"

Specimens: SYNTYPES or ISOSYNTYPES, \* Mt Cleughern, Southland, Crosby-Smith, no date, AK 8577, AK 210583 (formerly AK 8577.2).

*Euphrasia umbellata* Petrie, *Trans. Proc. N.Z. Inst.* 43:256 (1911)

TYPE LOCALITY: "Mouth of the Oreti River, Southland."

Specimens: SYNTYPES or ISOSYNTYPES, \* mouth of the Oreti River, Southland, J. Crosby Smith, no date, AK 8587-8588.

*Gratiola concinna* Colenso, *Trans. Proc. N.Z. Inst.* 19:264 (1887)

TYPE LOCALITY: "Edges of swamp in forest, south bank of the River Mangatawhainui, near Norsewood, County of Waipawa ... March, 1886: W.C."

Specimen: ? SYNTYPE, \* Norsewood, Hawkes Bay, W. Colenso, no date, AK 7634.

*Gratiola glandulifera* Colenso, *Trans. Proc. N.Z. Inst.* 17:245 (1885)

TYPE LOCALITY: "In boggy spots, edges of water-courses near Norsewood, County of Waipawa; 1884, but very local; flowering in March: W.C."

Specimen: ? SYNTYPE, \* Norsewood, Hawkes Bay, W. Colenso, no date, AK 7627.

***Hebe amplexicaulis*** (J.B. Armstr.) Cockayne et Allan var. ***erecta*** Cockayne et Allan, *Trans. Proc. N.Z. Inst.* 56:26 (1926)

TYPE LOCALITY: "South Island: Eastern Botanical District - On rocky outcrops at about 350 m altitude, upper Rangitata River, H.H.A."

Specimen: PARATYPE, near stream entering Rangitata river, above Gorge, H.H. Allan, 3.1.1919, AK 107695 (ex Herb. L. Cockayne), (holotype in CHR, †Garnock-Jones and Molloy 1982:395).

***Hebe brockiei*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:28 (1942)

TYPE LOCALITY: "Grassland on hills between Amuri Pass and Lake Man, at the head of the Doubtful River, Canterbury, at 1200-1500 m altitude."

Specimens: SYNTYPE, \* grassland on hills between Amuri Pass & Lake Man, at the head of the Doubtful River, Canterbury, 1200-1500 m, G.S. & J.S.T., no date, AK 107867; ? SYNTYPE, \* no locality, no collector, no date, AK 107866.

***Hebe buxifolia*** (Benth.) Cockayne var. ***pauciramosa*** Cockayne et Allan, *Trans. Proc. N.Z. Inst.* 56:27 (1926)

TYPE LOCALITY: "South Island: North-Western, Western, Fiord, and South Otago Botanical Districts - In wet ground, mainly subalpine: L.C."

Specimen: SYNTYPE, wet ground near Lake Harris, 3800 ft, L.C., 6 May 1921, AK 107674.

***Hebe fruticeti*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 70:30 (1940)

TYPE LOCALITY: "Subalpine scrub on basins at the head of the Estuary Burn, Lake Wanaka. Altitude 1000-1500 m."

Specimen: SYNTYPE, \* subalpine scrub, Estuary Burn, Lake Wanaka, no collector, no date, AK 22161 (ex Herb. G. Simpson and J.S. Thomson).

***Hebe murrellii*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:165 (1943)

TYPE LOCALITY: "... the Kepler range at sources of the Freeman River, near Fowler's Pass, Lake Manapouri."

Specimen: SYNTYPE, \* Fowler Pass, Geo. Simpson, no date, AK 22904.

***Hebe ochracea*** Ashwin in Allan, *Fl. N.Z.* 1:936 (1961)

TYPE LOCALITY: "Cobb Valley, BD 97077, F.G. Gibbs."

Specimen: ISOTYPE, \* Cobb Valley, near Mt Peel, Nelson, Apr 1903, AK 8243 (†Ashwin in Allan 1961:936), (holotype in CHR, †Ashwin in Allan 1961:936).

***Hebe pareora*** Garn.-Jones et Molloy, *N.Z. J. Bot.* 20:398 (1982)

TYPE LOCALITY: "Upper Pareora Gorge, on cliffs overhanging river, Garnock-Jones 1512, Molloy and Anderson, 4 Feb 1981, CHR 363050!"

Specimen: ISOTYPE, Upper Pareora Gorge, South Canterbury, P.J. Garnock-Jones 1512, B.J.P. Molloy and J.A. Anderson, 4/2/1981, AK 179708 (ex CHR), (holotype in CHR, †Garnock-Jones and Molloy 1982:398).

***Hebe pauciflora*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 73:166 (1943)

TYPE LOCALITY: "... the Kepler Range, near Fowler Pass, head of the Freeman River, Lake Manapouri."

Specimen: SYNTYPE, \* Fowler Pass, Geo Simpson, no date, AK 22903.

***Hebe pimeleoides*** (Hook.f.) Cockayne et Allan var. ***rupestris*** Cockayne et Allan, *Trans. Proc. N.Z. Inst.* 57:38 (1926)

TYPE LOCALITY: Not stated.

Specimen: LECTOTYPE, Dunstan Mts, at about 1800 m alt, L. Cockayne, 18 March 1919, AK 107758 (ex Herb. L. Cockayne, formerly AK 611, †Allan 1961:924).

***Hebe ramosissima*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 72:29 (1943)

TYPE LOCALITY: "Moist debris on Mount Tapuaenuku, Inner Clarence Basin, Marlborough, 2150 m altitude."

Specimen: SYNTYPE, \* Moist debris on Mount Tapuaenuku, Inner Clarence Basin, Marlborough, 2150 m, G.S. & J.S.T., no date, AK 107861.

***Hebe recurva*** G. Simpson et J.S. Thomson, *Trans. R. Soc. N.Z.* 70:32 (1940)

TYPE LOCALITY: "Rock platforms on the banks of the Aorere River near Bainham, Nelson ..."

Specimen: SYNTYPE, \* rock platforms on the banks of the Aorere River near Bainham, Nelson, no collector, no date, AK 22162 (ex Herb. G. Simpson and J.S. Thomson).

***Hebe topiaria*** L.B. Moore in Allan, *Fl. N.Z.* 1:917 (1961)

TYPE LOCALITY: "Mt Arthur Tableland, Nelson, BD 76137, F.G. Gibbs."

Specimen: ISOTYPE, \* Mount Arthur Nelson, F.G. Gibbs n576, no date, AK 8051 (holotype in CHR, †Moore in Allan 1961:917).

***Mazus novaezeelandiae*** W.R. Barker, *Roy. Soc. Tasm.*, Hobart:88 (1991)

TYPE LOCALITY: "B.V. Sneddon & T. Moss s.n., 8.xii.1986, Hawkins Gully Stream about 0.5 km from its outlet into the Makara Stream estuary, Wellington."

Specimens: ISOTYPE, New Zealand, North Island, Wellington District, Hawkins Gully Stream about 0.5 km from its outlet into the Makara Stream estuary, B.V. Sneddon & T. Moss sn, 8.xii.1966, AK 214468 (ex AD, †Barker 1991:89); PARATYPE, North Island, Hokianga County, Mitimiti, North Hokianga, A.E. Wright 2521, 15 November 1977, AK 143684 (†Barker 1991:91).

***Mitrasacme cheesemanii*** Buchanan, *Trans. Proc. N.Z. Inst.* 14:348 (1882)

TYPE LOCALITY: "South Island; Mount Alta, 5,000 ft alt - Buchanan and McKay, 1881."

Specimen: SYNTYPE, \* Mt Alta, Otago, fragment from type specimen, J. Buchanan & McKay, 1881, AK 8174.

***Mitrasacme petriei*** Buchanan, *Trans. Proc. N.Z. Inst.* 14:349 (1882)

TYPE LOCALITY: "South Island; Mount Bonpland, 6,000 ft alt, D. Petrie, 1881."

Specimen: SYNTYPE or ISOSYNTYPE, \* Mount Bonpland, Otago, 4500 ft, D. Petrie, no date, AK 8283.

***Ourisia prorepens*** Petrie, *Trans. Proc. N.Z. Inst.* 25:272 (1893)

TYPE LOCALITY: "Mount Bonpland, 4000ft."

Specimen: SYNTYPE, Mount Bonpland, Lake Co., 5000 ft, D. Petrie, no date, AK 8503.

***Parahebe catarractae*** (G. Forst.) W.R.B. Oliv. subsp. ***martinii*** Garn.-Jones, *N.Z. J. Bot.* 18:295 (1980)

TYPE LOCALITY: "Brian Boru Stream, N.E. of Chalk range, Marlborough, c. 1000 ft, A.P. Druce, 8.12.1975!"

Specimen: ISOTYPE, Brian Boru Stream, N.E. of Chalk Range, Marlborough, c. 1000 ft, A.P. Druce, 8 Dec 1975, AK 210584 (ex CHR), (holotype in CHR, †Garnock-Jones 1980:295).

***Parahebe decora*** Ashwin in Allan, *Fl. N.Z.* 1:877 (1961)

TYPE LOCALITY: "Hooker Valley, Mount Cook, 750 m altitude."

Specimens: HOLOTYPE, Hooker Valley, Mount Cook district, 2500 ft, T.F.C., no date, AK 8392 (†Ashwin in Allan 1961:877); ? ISOTYPE, AK 8391; ? ISOTYPES, Hooker Valley, alt. 2500 ft, T.F.C., Jan 1898, AK 8388; Hooker Valley, Mt Cook District, alt. 2500 ft, T.F.C., Jan 1909, AK 8389-8390.

***Parahebe laxa*** W.R.B. Oliv., *Rec. Dom. Mus.* 1:229 (1944)

TYPE LOCALITY: "Fine debris amongst rocks of moraine on the floor of the Homer Valley basin, near the tunnel, with *Myosotis laingii*, at 800 m altitude."

Specimens: SYNTYPES, \* fine debris amongst rocks of moraine on the floor of the Homer Valley basin, near tunnel with *Myosotis laingii*, 800 m, no collector, no date, AK 107862-107863.

***Parahebe linifolia*** (Hook.f.) W.R.B. Oliv. subsp. ***brevistylis*** Garn.-Jones, *N.Z. J. Bot.* 14:288 (1976)

TYPE LOCALITY: "Franz Josef Glacier, Westland, New Zealand. Garnock-Jones 302."

Specimen: ISOTYPE, Franz Joseph Glacier, Westland, New Zealand, P.J. Garnock-Jones, 13 Nov 1974, AK 141355 (ex CHR), (holotype in CHR, †Garnock-Jones 1976:288).

***Pygmaea myosotoides*** Ashwin in Allan, *Fl. N.Z.* 1:873 (1961)

TYPE LOCALITY: "Mt Pisa, 1800 m altitude."

Specimen: HOLOTYPE, \* Mt Pisa, 6000 ft, D. Petrie, no date, AK 8334 (†Ashwin in Allan 1961:873).

***Veronica adamsii*** Cheeseman, *Man. N.Z. Fl.*:786 (1925)

TYPE LOCALITY: "North Island: North Cape district, open hillsides by the road between Spirits Bay and Tom Bowline's [Bowling] Bay, not uncommon, Adams and T.F.C., January 1896. January-February."

Specimens: LECTOTYPE, Kapowairau to Tom Bowline's [Bowling] Bay, North Cape, T.F.C., Jan 1896, AK 7666 (†Garnock-Jones 1994:11); ISOLECTOTYPES, AK 7665, AK 203330 (formerly AK 7666).

***Veronica amabilis*** (Cheeseman) Cockayne et Allan var. ***blanda*** Cheeseman, *Man. N.Z. Fl.*:506 (1906)

TYPE LOCALITY: "Port Chalmers, Petrie! Preservation Inlet, Kirk! Stewart Island: Port William, Lyell; Paterson's Inlet, G.M. Thomson! Ruapuke Island, H.J. Matthews!"

Specimen: LECTOTYPE, Otago Harbour, D. Petrie, Feb 1893, AK 7804 (†Moore in Allan 1961:949).

***Veronica amplexicaulis*** J.B. Armstr., *N.Z. Ctry J.* 3:56 (1879)

TYPE LOCALITY: "Upper Rangitata, J.F. Armstrong."



Specimen, ? ISOLECTOTYPE, \* Upper Rangitata, Canterbury, J.B. Armstrong, no date, AK 8135 (lectotype in CHBG, †Garnock-Jones and Molloy 1982:395).

***Veronica arborea*** Buchanan, *Trans. Proc. N.Z. Inst.* 6:242 (1874)

TYPE LOCALITY: "... the neighbourhood of Wellington, in the rough bush country near Makara and Terawiti."

Specimen: SYNTYPE, \* near Cape Terawiti, Wellington, J. Buchanan, no date, AK 7854.

***Veronica armstrongii*** J.F. Johnson ex J.B. Armstr., *N.Z. Ctry J.* 3:59 (1879)

TYPE LOCALITY: "Upper Rangitata. J.F. Armstrong and W. Grey."

Specimen: ? SYNTYPE, \* Rangitata River, Canterbury, 4-6000 ft, J.B. Armstrong, 1869, AK 8252.

***Veronica astonii*** Petrie, *Trans. Proc. N.Z. Inst.* 40:288 (1908)

TYPE LOCALITY: "Crescit in scopulosis jugis Montis Hector apud Tararua Montes in insula boreali Novae-Zelandiae."

Specimen: SYNTYPE, \* Mount Hector, Tararua Range, D. Petrie, Jan 1907, AK 8191.

***Veronica barkeri*** Cockayne, *Trans. Proc. N.Z. Inst.* 31:421 (1899)

TYPE LOCALITY: "Chatham Islands; S.D. Barker (1898)."

Specimen: SYNTYPE, \* cultivated at Christchurch, plant originally from the Chatham Islands, L. Cockayne, no date, AK 7663.

***Veronica biggarii*** Cockayne, *Trans. Proc. N.Z. Inst.* 48:199 (1916)

TYPE LOCALITY: "Otago - on subalpine rocks, Eyre Mountains, at 1,200 m altitude; D.L. Poppelwell!"

Specimens: SYNTYPE, \* plant originally from Eyre Mts, Lake Wakitipu, subalpine belt (specimen from cultivated plants), D.L. Poppelwell, no date, AK 107833 (ex Herb. L. Cockayne); SYNTYPE or ISOSYNTYPE, \* Eyre Mts, D.L. Poppelwell, Xmas 1910, AK 37937.

***Veronica birleyi*** N.E. Br., *Kew Bull.* for 1911:345 (1911)

TYPE LOCALITY: "South Island: between rocks on the top ridge of Mount Bonpland, near Lake Wakatipu, 2435 m, Feb 1908, Miss L.S. Gibbs 1172."

Specimen: SYNTYPE, Mt Bonpland, between rocks on top ridge, 2000 m, L.S. Gibbs, Feb 1908, AK 8415 (ex Herb. L.S. Gibbs).

***Veronica bollonsii*** Cockayne, *Trans. Proc. N.Z. Inst.* 44:50 (1912)

TYPE LOCALITY: "Auckland - The Poor Knights Islands. L.C. Blooms in cultivation in the neighbourhood of Christchurch in April and later."

Specimen: SYNTYPE, \* Poor Knights Islands, L. Cockayne, no date, AK 7667.

***Veronica buchananii*** Hook.f., *Handbk. N.Z. Fl.*:211 (1864)

TYPE LOCALITY: "Middle Island: Otago, lake district, alpine, alt. 3-5000 ft, Hector and Buchanan."

Specimen: ISOSYNTYPE, \* Mt Alta, Otago, 6500 ft, J. Buchanan, no date, AK 8138.

***Veronica buchananii*** Hook.f. var. *exigua* Cheeseman, *Man. N.Z. Fl.*:527 (1906)

TYPE LOCALITY: "South Island; Canterbury - Mount Cook district (var. major and exigua), T.F.C."

Specimens: SYNTYPES, Hooker Glacier, 3500 ft, T.F.C., Jan 1898, AK 8147-8148.

*Veronica buchananii* Hook.f. var. *major* Cheeseman, *Man. N.Z. Fl.*:527 (1906)

TYPE LOCALITY: "South Island; Canterbury - Mount Cook district (var. major and exigua), T.F.C. Mount Kyeburn (var. major), Petrie! H. J. Matthews!"

Specimens: SYNTYPES, Hooker Glacier, Canterbury, 3000 ft, T.F.C., no date, AK 8142-8143; Mount Sebastopol, Hooker Valley, 4500 ft, T.F.C., Jan 1898, AK 8144; \* top of Kyeburn, Otago, H.J. Matthews, no date, AK 8146.

*Veronica buxifolia* Benth. var. *patens* Cheeseman, *Man. N.Z. Fl.*:523 (1906)

TYPE LOCALITY: "Plentiful from Nelson to Foveaux Strait."

Specimen: LECTOTYPE, Mount Arthur Plateau, Nelson, alt. 4000 ft, T.F.C., no date, AK 8076 (†Moore in Allan 1961:924).

*Veronica carsei* Petrie, *T.N.Z.I.* 55:96 (1924)

TYPE LOCALITY: "Margins of forests and woods, Waimarino Plain: W. Townson! H. Carse! H.B. Matthews! Kaimanawa Range: B.C. Aston!"

Specimens: SYNTYPE, Rotoaira Rd, edge of bush, H.C., H.B.M., D.P., Jan, AK 37929 (ex Herb. H.B. Matthews); SYNTYPES or ISOSYNTYPES, edge of forest, Rotoaira Road, near Whakapapaaiti R., Waimarino Plains, H. Carse & H.B. Matthews, Jan 1921, AK 7963 (ex Herb. H. Carse); from margin of forest, Waimarino Plain, H. Carse, Jan 1921, AK 7966; Rotoaira Rd, H.B.M. & H.C., 19 Jan 1921, AK 37926 (ex Herb. H.B. Matthews), AK 37928 (ex Herb. H.B. Matthews); Waimarino P, H.C., 20/1/21, AK 37930 (ex Herb. H.B. Matthews); \* Waimarino Plains, H.B.M., 29/12/1920, AK 214661 (formerly AK 37930, ex Herb. H.B. Matthews); Waimarino plain near east margin of forest, H.C. & H.B.M., Jan. 1918, AK 37931 (ex Herb. H.B. Matthews); Waimarino, H.C., Jan 1918 or 20/01/1921 or 29/12/20, AK 37932 (ex Herb. H.B. Matthews).

*Veronica cheesemanii* Benth., *Jc. Pl.* 48:plate 1366A (1881)

TYPE LOCALITY: "New Zealand; Nelson, on the Raglan Mountains, Wairau Valley, alt. 5000 ft, T.F. Cheeseman."

Specimen: ISOSYNTYPE, Raglan Range, Wairau Valley, alt. 5000 ft, T.F.C., Jan 1881, AK 8428.

*Veronica coarctata* Cheeseman, *Man. N.Z. Fl.*:531 (1906)

TYPE LOCALITY: "South Island: Nelson - Mount Arthur and Mount Owen, T.F.C.; Mount Owen and Brunner Range, Townson! 3500-5000 ft. January-March."

Specimens: LECTOTYPE, Mount Arthur Plateau, Nelson, 4000 ft, T.F.C., Jan 1886, AK 8233 (†Allan 1961:930); PARALECTOTYPES, Mount Arthur Plateau, Nelson, alt. 4500 ft, T.F.C., Jan 1881, AK 8230; Mount Arthur, Nelson, alt. 4000 ft, T.F.C., Jan 1886, AK 8232; \* Brunner Range, Nelson, 3000-5000 ft, W. Townson, no date, AK 8234; \* Mount Owen, Nelson, W. Townson, no date, AK 8235.

*Veronica cockayneana* Cheeseman, *Man. N.Z. Fl.*:522 (1906)

TYPE LOCALITY: "South Island: Nelson - Mount Lyell and Mount Murchison, Townson! near Reefton, R.W. Raithby! Otago - Humboldt Mountains, Cockayne! Clinton Valley,

Petrie! 2000-4500 ft. December-February.”

Specimen: SYNTYPE, \* Humboldt Mountains, Otago, L. Cockayne, no date, AK 8054 (ex Herb. L. Cockayne).

***Veronica darwiniana*** Colenso, *Trans. Proc. N.Z. Inst.* 25:332 (1893)

TYPE LOCALITY: “On hills in the interior, Hawkes’ Bay; 1890-92: W.C.”

Specimens: ? SYNTYPES, \* Hawkes Bay, W. Colenso, no date, AK 7968, AK 214495; \* Hawkes Bay, W. Colenso, 1891, AK 7969.

***Veronica dasyphylla*** Kirk, *Trans. Proc. N.Z. Inst.* 28:519 (1896)

TYPE LOCALITY: “South Island: Nelson - Mount Arthur, &c., W.H. Bryant! Otago - West Coast Sounds, Lake District and Mount Alta, J. Buchanan! Ben Lomond and Old Man Range, D. Petrie! 3,500 ft-5,000 ft.”

Specimen: SYNTYPE, \* Otago Sounds, J. Buchanan, no date, AK 8289 (ex Herb. T. Kirk).

***Veronica dasyphylla*** Kirk var. *minor* G. Simpson et J.S. Thomson, *Trans. Roy. Soc. N.Z.* 72:30 (1943)

TYPE LOCALITY: “Turfy hollows amongst low grasses and other vegetation on the summit of Mount St Mary, Kurow, Waitaki Valley.”

Specimen: SYNTYPE, \* turf hollows amongst low grasses and other vegetation on summit of Mt St Mary, Kurow, Waitaki Valley, G.S. & J.S.T., no date, AK 107848.

***Veronica dasyphylla*** Kirk var. *subacuta* Simpson et Thomson, *Trans. Roy. Soc. N.Z.* 72:30 (1943)

TYPE LOCALITY: “Peaty ridges at Rough Peaks, lake Wakitipu.”

Specimen: SYNTYPE, \* peaty ridges at Rough Peaks, Lake Wakitipu, G.S. & J.S.T., no date, AK 107847.

***Veronica divergens*** Cheeseman, *Man. N.Z. Fl.*:502 (1906)

TYPE LOCALITY: “South Island: Nelson - Coast near Brighton, to the south of Westport, Townson!”

Specimen: SYNTYPE, \* Brighton, south of Westport, W. Townson, no date, AK 7691.

***Veronica dorrien-smithii*** Cockayne, *Trans. Proc. N.Z. Inst.* 44:51 (1912)

TYPE LOCALITY: “Chatham Island: Growing on peaty ground at margin of Lake Tekua Taupo at an altitude of 240 m ...”

Specimen: SYNTYPE, Growing on steep peaty bank of Lake Tekua Taupo, tobacco country, Chatham Island, L. Cockayne & F.A.D. Cox, Feb 1901, AK 7660 (ex Herb. L. Cockayne).

***Veronica gibbsii*** Kirk, *Trans. Proc. N.Z. Inst.* 28:524 (1896)

TYPE LOCALITY: “South Island; Nelson - Mount Rintoul and Ben Nevis; 3,000-4,000 ft; F.G. Gibbs!”

Specimens: SYNTYPE, Mount Rintoul, no collector (label in Kirk’s hand), no date, AK 8098 (ex Herb. T. Kirk); ? SYNTYPES or ISOSYNTYPES, \* Ben Nevis, alt 4000 ft, F.G. Gibbs, no date, AK 8099-8101.

***Veronica glaucophylla*** Cockayne, *Trans. Proc. N.Z. Inst.* 31:422 (1899)

TYPE LOCALITY: Craigieburn Mountains, Canterbury, at altitude of 1,200 m (1890); L.C.”

Specimen: ? NEOTYPE, cultivated plant, originally from Craigieburn Mountains, no collector (label in Cockayne's hand), Jan 11th 1902, AK 7970 (ex Herb. L. Cockayne, †Moore in Allan 1961:917 as "type").

*Veronica insularis* Cheeseman, *Trans. Proc. N.Z. Inst.* 29:392 (1897)

TYPE LOCALITY: "Three Kings Islands; rocky places on both the Great King and Western King but not common."

Specimens: SYNTYPES, Three Kings Islands, T.F.C., Nov 1889, AK 7888-7890.

*Veronica laevis* Benth. var. *carnosula* Hook.f., *Fl. N.Z.* 1:194 (1854)

TYPE LOCALITY: Not stated.

Specimen: ? SYNTYPE, \* N. Zealand, Upper Wairau, D. Munro 1850, ? no date, AK 8103 (ex K).

*Veronica laingii* Cockayne, *Rep. Bot. Surv. St. Id.*:44 (1909)

TYPE LOCALITY: "Stewart Island: Near summit of Mount Anglem ..."

Specimen: SYNTYPE, Mount Anglem, near summit, Stewart Island, L.C., Jan 1907, AK 107837 (ex Herb. L. Cockayne).

*Veronica leiophylla* Cheeseman, *Man. N.Z. Fl.*:509 (1906)

TYPE LOCALITY: "South Island: Apparently not uncommon throughout, from Nelson to Otago. Sea-level to 3000 ft."

Specimens: ? SYNTYPES, \* Tuamarina Swamp, near Picton, J.H. Macmahon, no date, AK 7855; \* Pelorus Sound, Marlborough, J.H. Macmahon, no date, AK 7856; \* Marlborough, J.H. Macmahon, no date, AK 7857-7858; \* Awatere River, Marlborough, J.H. Macmahon, no date, AK 7859; \* Awatere Valley, Marlborough, J.H. Macmahon, no date, AK 7860; \* Awatere Valley, Marlborough, H.J. Matthews, no date, AK 7861; \* Mason River, Marlborough, H.J. Matthews, no date, AK 7862; \* Mason River, Rev. H.J. Spencer, no date, AK 7864; Mt Fyffe, Kaikoura, L.C., Jan 1892, AK 7865 (ex Herb. L. Cockayne); Wairau Valley, Nelson, 1500 ft, T.F.C., no date, AK 7866; Buller Valley, Nelson, alt. 1500 ft, T.F.C., Jan 1881, AK 7867; Hanmer Plains District, foot of Mt Captain, L.C., Nov 1896, AK 7868 (ex Herb. L. Cockayne); growing within the bush gully on Jack's Pass, Hanmer Plains, L. Cockayne, Feb 1889, AK 7869 (ex Herb. L. Cockayne); Hanmer Plains District, no collector (label in Cockayne's hand), Nov 1896, AK 7870 (ex Herb. L. Cockayne); \* Hanmer Plains, D.L. Poppelwell, no date, AK 7871; \* Banks Peninsula, R.M. Laing, no date, AK 7872, AK 7875; \* Little Rapali, Banks Peninsula, R.M. Laing, no date, AK 7873; \* Crown Island, Banks Peninsula, R.M. Laing, no date, AK 7874; \* Blue Mountains, Otago, 800-1000 ft, H.J. Matthews, no date, AK 7876; Clutha Valley, Dunedin, no collector (label in Petrie's hand), no date, AK 7877 (ex Herb. D. Petrie).

*Veronica macrantha* Hook.f. var. *brachyphylla* Cheeseman, *Man. N.Z. Fl.*:537 (1906)

TYPE LOCALITY: "Specimens from Mount Arthur and other parts of the Nelson district."

Specimen: SYNTYPE, Mount Arthur, Nelson, alt. 5000 ft, T.F.C., Jan 1886, AK 58896.

*Veronica macrocarpa* Vahl var. *affinis* Cheeseman, *Man. N.Z. Fl.*:505 (1906)

TYPE LOCALITY: Not stated.

Specimen: HOLOTYPE, cliffs at Northcote, Auckland Harbour, T.F.C., 1875, AK 7730.

*Veronica macrocarpa* Vahl var. *crassifolia* Cheeseman, *Man. N.Z. Fl.*:505 (1906) ≡ *V. townsonii* Cheeseman, *Trans. Proc. N.Z. Inst.* 45:95 (1913)

TYPE LOCALITY: "Nelson, between Karamea and Westport, W. Townson!"

Specimen: SYNTYPE, \* Karamea Hill, N.W. Nelson, W. Townson, no date, AK 7799.

*Veronica macroura* Hook.f. ex Benth. var. *dubia* Cheeseman, *Man. N.Z. Fl.*:501 (1906) ≡ *V. obtusata* Cheeseman, *Trans. Proc. N.Z. Inst.* 48:213 (1916)

TYPE LOCALITY: "Coast north of the Manukau Harbour, T.F.C."

Specimens: SYNTYPES, Muriwai Cliffs near Motutara, T.F.C., March 1889, AK 7670; Muriwai Cliffs near Motutara, T.F.C., March 1884, AK 7671-7672; Waitakere West, cliffs near Karekare, T.F.C., March 1884, AK 7673.

*Veronica matthewsii* Cheeseman, *Man. N.Z. Fl.*:517 (1906)

TYPE LOCALITY: "South Island: Canterbury - Southern Alps, Haast! Armstrong! Otago - Milford Sound, Enys! Humboldt Mountains, H.J. Matthews!"

Specimen: SYNTYPE, \* Humboldt Mountains, Otago, H.J. Matthews, no date, AK 7955.

*Veronica menziesii* Benth. var. *divaricata* Cheeseman, *Man. N.Z. Fl.*:512 (1906)

TYPE LOCALITY: "Not uncommon in the Pelorus and Rai valleys, Marlborough, Macmahon!"

Specimen: SYNTYPE, \* Rai Valley, Marlborough, J.H. Macmahon, no date, AK 7909.

*Veronica obovata* Kirk, *Trans. Proc. N.Z. Inst.* 9:502 (1877)

TYPE LOCALITY: "Broken River, Canterbury. Alt. 2,000 ft. J.D. Enys and T. Kirk."

Specimen: ? SYNTYPE, Castle Hill Basin, Cantby, T. Kirk, no date, AK 8038.

*Veronica obtusata* ≡ *V. macroura* var. *dubia*

*Veronica parviflora* Vahl var. *strictissima* Kirk, *Trans. Proc. N.Z. Inst.* 28:527 (1896)

TYPE LOCALITY: "South Island: Akaroa, 1876, T. Kirk."

Specimen: SYNTYPE, \* Akaroa, Banks Peninsula, T. Kirk, no date, AK 7879.

*Veronica propinqua* Cheeseman, *Man. N.Z. Fl.*:533 (1906)

TYPE LOCALITY: "South Island: Otago - Upper Waipori and Maungatua, Petrie! Mount Ida and Mount Bonpland, H.J. Matthews! 2500-5000 ft. December-February."

Specimen: SYNTYPE, Maungatua Hill, Taieri Co., 2900 ft, no collector (label in Petrie's hand), no date, AK 8258 (ex Herb. D. Petrie).

*Veronica propinqua* Cheeseman var. *major* Cockayne ex Cheeseman, *Man. N.Z. Fl.*:820 (1925)

TYPE LOCALITY: "Not uncommon in the uplands of Otago, Cockayne!"

Specimen: SYNTYPE, Mount Dick, L.C., April 1921, AK 50973 (ex Herb. L. Cockayne).

*Veronica rigidula* Cheeseman, *Man. N.Z. Fl.*:514 (1906)

TYPE LOCALITY: "South Island: Marlborough - Pelorus and Rai Valleys (on rocks by the side of streams), Mount Duppa, Maungatapu, J.H. Macmahon! Nelson - Wairau Gorge, T.F.C. Sea level to 4000 ft. December-February."

Specimen: SYNTYPE, \* Pelorus River, Marlborough, 5000 ft, J. Macmahon, September, AK 7919.

*Veronica rupicola* Cheeseman, *Man. N.Z. Fl.*:514 (1906)

TYPE LOCALITY: "South Island: Marlborough - Awatere Valley, Sinclair! Kaikoura Mountains, Buchanan! Gorge of the Conway River, Cockayne!"

Specimen: SYNTYPE, \* gorge of the Conway River, Marlborough, 3000 ft, L. Cockayne, no date, AK 7926.

*Veronica salicifolia* G. Forst. var. *communis* Cockayne, *Trans. Proc. N.Z. Inst.* 48:201 (1916)

TYPE LOCALITY: "Throughout the South Island ... from sea level to the subalpine belt and from the coast-line to the interior."

Specimen: SYNTYPE, \* terrace of the R. Kowai near Springfield, A.H.C., 16/2/1902, AK 7739 (ex Herb. L. Cockayne).

*Veronica salicifolia* G. Forst. var. *longeracemosa* Cockayne, *Trans. Proc. N.Z. Inst.* 49:61 (1917)

TYPE LOCALITY: "North Island: Egmont - Wanganui Botanical District, abundant with other shrubs in open places both wet & dry. L.C."

Specimen: SYNTYPE, on "papa" cliff near Moumahaki, L.C., March 1916, AK 8459 (ex Herb. L. Cockayne).

*Veronica salicifolia* G. Forst. var. *paludosa* Cockayne, *Trans. Proc. N.Z. Inst.* 48:202 (1916)

TYPE LOCALITY: "South Island: Westland - In lowland swamps."

Specimen: SYNTYPE, swamp, Lake Ianthe, Westland, L.C., no date, AK 7776 (ex Herb. L. Cockayne).

*Veronica speciosa* R. Cunn. var. *brevifolia* Cheeseman, *Man. N.Z. Fl.*:500 (1906)

TYPE LOCALITY: "North Cape, T.F.C."

Specimen: SYNTYPE, North Cape, T.F.C., Jan 1896, AK 7653 .

*Veronica subalpina* Cockayne, *Trans. Proc. N.Z. Inst.* 31:420 (1899)

TYPE LOCALITY: "Mountains of Westland, and those of Canterbury within region of western rainfall, at altitude of from 750 m to 1,200 m."

Specimen: SYNTYPE, Mt Rangi Taipo, Westland, 1000 m, L.C., Jan 1896, AK 8012 (ex Herb. L. Cockayne).

*Veronica thomsonii* (Buchanan) Cheeseman var. *glabra* Cheeseman, *Man. N.Z. Fl.*:540 (1906)

TYPE LOCALITY: "South Island: Otago - Mount Alta, Buchanan and McKay! Kurow Mountains, Mount St Bathans, Mount Pisa, Petrie! 4500-6500 ft."

Specimen: SYNTYPE, \* Mt Pisa, Otago, alt. 6000 ft, D. Petrie, no date, AK 8335.

*Veronica townsonii* ≡ *V. macrocarpa* var. *crassifolia*

*Veronica traversii* Hook.f. var. *elegans* Cheeseman, *Man. N.Z. Fl.*:519 (1906)

TYPE LOCALITY: "South Island: Abundant in mountain districts from Nelson to Otago. 500-3500 ft. December-February."

Specimen: LECTOTYPE, \* Craigieburn, Upper Waimakiriri, Canterbury, L. Cockayne, no date, AK 8004 (†Moore in Allan 1961:915).

*Veronica traversii* Hook.f. var. *fallax* Cheeseman, *Man. N.Z. Fl.*:519 (1906)

TYPE LOCALITY: "South Island: Abundant in mountain districts from Nelson to Otago. 500-3500 ft. December-February."

Specimen: SYNTYPES, \* St James Station, Clarence River, 3000 ft, T. Kirk 775, no date, AK 7978; ? SYNTYPE, Mount Mantell, Nelson, alt 4000 ft, W. Townson 613, no date, AK 7989.

*Veronica truncatula* Colenso, *Trans. Proc. N.Z. Inst.* 31:276 (1899)

TYPE LOCALITY: "Ruahine Mountain-range, east side; February, 1898: Mr H. Hill."

Specimen: ? SYNTYPE, \* Ruahine Range, H. Hill, Feb 1899, AK 8436.

*Veronica tumida* Kirk, *Trans. Proc. N.Z. Inst.* 28:521 (1896)

TYPE LOCALITY: "South Island: Nelson - Mount Rintoul and Ben Nevis, F.G. Gibbs! Mount Starvation, W.H. Bryant! Otago - J. Buchanan! 3,000-4,500 ft."

Specimen: SYNTYPE, Mount Starveall, no collector (label in Kirk's hand), no date, AK 8186 (ex Herb. T. Kirk).

*Veronica venustula* Colenso, *Trans. Proc. N.Z. Inst.* 27:393 (1895)

TYPE LOCALITY: "On eastern side of Ruahine Mountain-range, County of Waipawa; 1892-94: Mr A. Olsen."

Specimen: ? SYNTYPE, \* east side of Ruahine range, A. Olsen, Dec 1893, AK 7891.

*Veronica vernicosa* Hook.f. var. *gracilis* Cheeseman, *Man. N.Z. Fl.*:520 (1906)

TYPE LOCALITY: "South Island: Mountain districts in Nelson, Marlborough, Canterbury and Westland, not uncommon. Sea level to 4500 ft. December-February."

Specimen: LECTOTYPE, Mt Arthur Plateau, Nelson, alt. 3500 ft, T.F.C., no date, AK 8032 (†Moore in Allan 1961:900).

*Veronica vernicosa* Hook.f. var. *multiflora* Cheeseman, *Man. N.Z. Fl.*:520 (1906)

TYPE LOCALITY: "South Island: Mountain districts in Nelson, Marlborough, Canterbury, and Westland, not uncommon. Sea level to 4500 ft. December-February."

Specimen: LECTOTYPE, \* cultivated in Mr Matthews' garden, H.J. Matthews, no date, AK 8029 (†Moore in Allan 1961:900).

## SOLANACEAE

*Solanum aviculare* G. Forst. var. *albiflorum* Cheeseman, *Trans. Proc. N.Z. Inst.* 52:11 (1920)

TYPE LOCALITY: "Pukekohe."

Specimens: SYNTYPES, \* near Pukekohe, W. Townson, no date, AK 7602, AK 210585 (formerly AK 7602.2).

## STACKHOUSIACEAE

*Stackhousia uniflora* Colenso, *Trans. Proc. N.Z. Inst.* 18:258 (1885)

TYPE LOCALITY: "On open spots, banks of River Manawatu, County of Waipawa, November 1884; Mr Henry Hill."

Specimen: ? SYNTYPE, \* open spots, banks on the Manawatu, Waipawa Co., H. Hill, 1884, AK 5111.

STYLIDIACEAE

***Forstera major*** Colenso, *Trans. Proc. N.Z. Inst.* 31:272 (1899)

TYPE LOCALITY: "Ruahine Mountain-range, east side; 1898: Mr H. Hill."

Specimen: ? SYNTYPE, \* Ruahine Mountains, H. Hill, no date, AK 9299.

***Forstera sedifolia*** G. Forst. var. ***oculata*** Cheeseman, *Man. N.Z. Fl.*:393 (1906)

TYPE LOCALITY: "Mount Rochfort, near Westport, W. Townson! Humboldt Mountains, Cockayne! Clinton Saddle, Petrie! Frazer Peaks (Stewart Island), Thomson and Petrie!"

Specimens: SYNTYPE, growing on moist bank in partial shade, near water, Humboldt Mountains, Otago Lake District, 1060 m, L. Cockayne, 10.ii.1897, AK 9291 (ex Herb. L. Cockayne); \* Frazer Peak, Stewart's Island, D. Petrie, no date, AK 9292.

***Forstera truncatella*** Colenso, *Trans. Proc. N.Z. Inst.* 20:196 (1888)

TYPE LOCALITY: "Banks of a small mountain stream on the west side of Mount Ngaruahoe; altitude 5,200 ft, County of east Taupo; 1887, Mr H. Hill."

Specimen: ? SYNTYPE, \* Ngaruahoe, H. Hill, no date, AK 9296.

THYMELAEACEAE

***Drapetes dieffenbachii*** Hook.f. var. ***laxa*** Cheeseman, *Man. N.Z. Fl.*:616 (1906)

TYPE LOCALITY: "Ruahine Mountains, H. Tryon! Nelson - Mountains flanking the Wairau Valley, T.F.C., Mount Murchison, Townson! 2000-4500 ft. December - March."

Specimens: SYNTYPES, \* Ruahine Mountains, H. Tryon, no date, AK 5465 (†Heads 1990:630); St. Arnaud Mountains, Nelson, 4000 ft, T.F.C., Jan 1898, AK 5462-5463; \* Mount Murchison, Buller Valley, 3500 ft, W. Townson, no date, AK 5464.

***Drapetes villosa*** (Bergg.) Cheeseman var. ***multiflora*** Cheeseman, *Man. N.Z. Fl.*:616 (1906)

TYPE LOCALITY: "Nelson - Mount Arthur Plateau, T.F.C.; Mount Faraday, Townson! Canterbury - Candlestick Mountains, Cockayne! Mount Torlesse, T.F.C. Westland - Kelly's Hill, Petrie! 2500-4500 ft. December-March."

Specimens: SYNTYPES, \* Mt Faraday, 4000 ft, no collector (label in Cheeseman's hand), no date, AK 5474; Mount Torlesse, Canterbury, alt. 5000 ft, T.F.C., Jan 1880, AK 5476; Arthur Plateau, Nelson, alt. 3500 ft, T.F.C., Jan 1886, AK 5477-5478; head of Nigger Creek, Candlestick Mountains, 900 m, L. Cockayne, 8 01 1900, AK 5479 (ex Herb. L. Cockayne).

***Kelleria tessellata*** Heads, *Austr. Syst. Bot.* 3:620 (1990)

TYPE LOCALITY: "T.F. Cheeseman, i 1866, Mount Peel, Nelson, 4500 ft (AK 5466)."

Specimen: HOLOTYPE, Mount Peel, Nelson, alt. 4500 ft, T.F.C., Jan 1886, AK 5466 (†Heads 1990:620).

***Pimelea aridula*** ≡ ***P. lyalli*** var. ***sericea***

***Pimelea gnidia*** (J.R. et G. Forst.) Willd. var. ***pulchella*** Cheeseman, *Man. N.Z. Fl.*:609 (1906)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPE, Mt Owen, Nelson, alt. 4000 ft, T.F.C., Jan 1882, AK 5357; ? SYNTYPES, \* Mount Stokes, Marlborough, P. Macmahon, no date, AK 5356 (ex Herb. T. Kirk); \* near Westport, W. Townson, no date, AK 5358.



*Pimelea lyalli* Hook.f. var. *sericea* Cheeseman, *Man. N.Z. Fl.*:614 (1906)  $\equiv$  *P. aridula* Cockayne, *Veg. N.Z.*:356 (1921)

TYPE LOCALITY: "North Island, Ruahine Range, Colenso! Hawkes Bay, A. Hamilton! South Island, Kurow and other places in the Waitaki Valley, Buchanan! Petrie! Clutha Valley, Petrie! Crown Range, Cardrona, Kirk! Usually from 2000 ft to 4500 ft, but descends to sea-level in the south of Otago and on Stewart Island. Dec-March."

Specimen: SYNTYPE, \* Kurow, Waitaki Valley, D. Petrie, no date, AK 5402.

*Pimelea polycephala* Colenso, *Trans. N.Z. Inst.* 22:486 (1890)

TYPE LOCALITY: "Near the summit of Mount Ruapehu, in dry stony ground, County of East Taupo; 1889: Mr H. Hill."

Specimen: ? SYNTYPE, \* near the summit of Ruapehu, H. Hill, no date, AK 5431.

*Pimelea prostrata* (J.R. et G. Forst.) Willd. var. *alpina* Cheeseman, *Man. N.Z. Fl.*:583 (1925)

TYPE LOCALITY: Not stated.

Specimen: SYNTYPE, \* Ruapehu, W. Townson, no date, AK 5420.

*Pimelea prostrata* (J.R. et G. Forst.) Willd. var. *erecta* Cheeseman, *Man. N.Z. Fl.*:583 (1925)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, Avondale, near Auckland, T.F.C., no date, AK 5407; Taupaki, near Auckland, T.F.C., no date, AK 5408; ? SYNTYPES, \* sandhills near Christchurch, J.F. Armstrong, no date, AK 5404; \* Tairua Harbour, J. Adams, no date, AK 5405-5406.

*Pimelea prostrata* (J.R. et G. Forst.) Willd. var. *repens* Cheeseman, *Man. N.Z. Fl.*:583 (1925)

TYPE LOCALITY: Not stated.

Specimens: SYNTYPES, stony ground in full sunshine, Glenorchy, Lake Wakitipu, L. Cockayne, 24 Feb 1897, AK 5409 (ex Herb. L. Cockayne); in full sunshine on stony bed of Mt Earnslaw Creek, Otago Lake Distr., L. Cockayne, 18 Feb 1897, AK 5410 (ex Herb. L. Cockayne); \* Cobb Valley, Nelson, 2500 ft, T.F.C., Jan 1882, AK 5413; Dun Mountain, Nelson, T.F.C., no date, AK 5414; Patetere Plateau, T.F.C., Jan 1884, AK 5415; Mount Kakaramea, Taupo, alt. 4000 ft, T.F.C., Jan 1905, AK 5416, AK 219734 (formerly AK 5416.2); Waitakerei West, T.F.C., October 1883, AK 5417; Waitemata Harbour, T.F.C., Dec 1884, AK 5418.

## URTICACEAE

*Boehmeria dealbata* Cheeseman, *Trans. Proc. N.Z. Inst.* 24:410 (1892)

TYPE LOCALITY: "Sunday Island, Kermadec Group: not uncommon in the lower portion of the island."

Specimens: SYNTYPES, Sunday Island, Kermadec Group, T.F.C., August 1887, AK 3795, AK 210748-210750 (formerly AK 3795.2-3795.4); Kermadec Islands, T.F.C., no date, AK 3796; cultivated at Remuera, T.F.C., no date, AK 3797.

*Urtica aspera* Petrie, *Trans. Proc. N.Z. Inst.* 51:107 (1919)

TYPE LOCALITY: "Among tussock grass in the more open parts of Firewood Creek, Cromwell, at about 2,300 ft, Sowburn, Maniototo County, among patches of *Discaria toumatou* Raoul; D.P. Head of Awatere Valley, Marlborough: L. Cockayne."

Specimens: ? SYNTYPES, \* Firewood Creek, near Cromwell, Otago, D. Petrie, no date, AK

3784, AK 210751 (formerly AK 3784.2); ? SYNTYPES, Maniototo Plains, Otago, D. Petrie, no date, AK 3785, AK 210752 (formerly AK 3785.2).

## VERBENACEAE

*Teucrium parvifolium* Hook.f. var. *luxurians* Cheeseman, *Man. N.Z. Fl.*:764 (1925)

TYPE LOCALITY: "River-flats by the Mangles River, Buller Valley, H.H. Allan!"

Specimens: SYNTYPES, remnants of forest (Beech-Hoheria-Sophora) on river flats, Mangles R near Braeburn, H.H. Allan, 20 Jan 1922, AK 7589; \* remnants of forest (Beech-Hoheria-Sophora) on river flats, Mangles R near Braeburn, H.H. Allan, 20 Jan 1922, AK 209583 (formerly AK 7589.2).

## VIOLACEAE

*Melicytus lanceolatus* Hook.f. var. *laticus* G. Simpson et J.S. Thomson, *Trans. Roy. Soc. N.Z.* 72:25 (1943)

TYPE LOCALITY: "... Flagstaff Hill, near Dunedin ..."

Specimen: SYNTYPE, \* type from Flagstaff Hill, Dunedin, G.S. & J.S.T., no date, AK 100240.

*Melicytus micranthus* Hook.f. var. *longiusculus* Cheeseman, *Man. N.Z. Fl.*:48 (1906)

TYPE LOCALITY: "North and South Islands: Abundant in lowland forests, by the side of streams, &c., from the Bay of Islands to Otago. November-May."

Specimens: SYNTYPES, \* Mauku, H. Carse, June 1900, AK 5290-5291, AK 5294, AK 209541-209544; Mauku Creek, H. Carse, July 1900, AK 5292; Hogwoods Scrub, Mauku, H. Carse, Dec 1900, AK 5293.

*Melicytus microphyllus* Colenso, *Trans. Proc. N.Z. Inst.* 19:260 (1887)

TYPE LOCALITY: "Forests, banks of the River Mangatawhainui, near Norsewood, County of Waipawa; 1886: W.C."

Specimens: ? SYNTYPES, \* Norsewood, Hawkes Bay, W. Colenso, no date, AK 5297, AK 209574 (formerly AK 5297.2).

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JULIET F. HERRICK and EWEN K. CAMERON, Auckland Institute and Museum, Private Bag 92018, Auckland.

APPENDIX 1. Interpretations of the International Code of Botanical Nomenclature used for this checklist.

Holotype

One specimen cited by the author in the protologue or designated by the author as the type. If there was only one specimen seen by the author this is the holotype, some authors refer to such specimens as “monotypes” (Fosberg 1993).

Isolectotype

Specimen which is a duplicate of the lectotype.

Isonesotype

Specimen which is a duplicate of the neotype.

Isosyntype

Specimen which is a duplicate of a syntype but which has not been seen by the author.

Isotype

Specimen which is a duplicate of the holotype.

Lectotype

One specimen selected from syntype material to be nomenclatural type and published at a date later than the original publication of the description.

Neotype

One specimen selected to serve as a nomenclatural type when all original type material is missing.

Paralectotype

After a lectotype has been selected, any specimen cited in the protologue which is not the lectotype or an isolectotype. Both terms paralectotype (Hansen & Seberg 1984) and lectotparatype (Brummitt 1985) are currently used in this sense, we have used paralectotype.

Paratype

Specimen cited in the protologue which is neither holotype nor isotype. Note that where a holotype or lectotype is clearly an entire plant, any specimens collected at the same time are not duplicates in a strict sense and therefore we have taken them to be either paratypes or paralectotypes.

Syntype

Any specimen cited in the protologue when no holotype or lectotype has been selected.





# A NEW UPPER CRETACEOUS SPECIES OF *ISSELICRINUS* (CRINOIDEA: ARTICULATA) FROM WESTERN HAWKES BAY, NEW ZEALAND

MICHAEL K. EAGLE

*Abstract.* A new species of crinoid, *Isselocrinus mangahouangaensis*, is described from the Upper Cretaceous Maungataniwha Sandstone, western Hawkes Bay, North Island, New Zealand. It is the first record of the genus from New Zealand and the first crinoid to be described from the Cretaceous of New Zealand. It lived in an inner shelf, marine paleoenvironment and is the remnant of a Tethyan fauna that migrated to New Zealand.

Extensive collecting at Mangahouanga Stream, western Hawkes Bay, has yielded dinosaur remains (Wiffen 1980, 1981, 1983, 1986; Wiffen & Molnar 1988; Molnar 1981; Scarlet & Molnar 1984), marine reptiles (Wiffen & Molesley 1986), Osteichthyes (Wiffen 1983), Crustacea (Glassner 1980), molluscs (Crampton 1988; Crampton & Moore 1990), ammonites, brachiopods, nautiloids, belemnites, annelids (Crampton & Moore 1990), barnacles (Buckeridge 1991), Chondrichthyes (Keyes 1977), insects (Craw & Watt 1987), and plant macrofossils (Crampton & Moore 1990). Dinoflagellates (Wilson & Moore 1988), foraminifera, and pollen (Crampton & Moore 1990) are also present. The fossil remains occur *in situ* in the sandstone matrix and in loose, locally derived, calcareous and phosphatic concretions (Moore *et al.* 1989; Crampton & Moore 1990; Issac *et al.* 1991). The locality is 100 m of stream bed at New Zealand Fossil Record localities V19/f6909 (grid reference V19/420469-421469; Fig.1). The boulders are indurated, grey, medium-grained calcareous sandstone (Moore 1986) that have been eroded out of the thick Mangataniwha Sandstone sequence exposed in the banks and bed of Mangahouanga Stream (Wiffen 1980, 1986).

## GEOLOGY (Fig. 1)

The Maungataniwha Sandstone Member (of Tahora Formation; Isaac *et al.* 1991) consists of moderately indurated, poorly bedded, fine-grained, highly bioturbated, grey-mottled sandstone and lenticular shell-beds. Low angle planar cross-bedding and minor, low amplitude symmetrical ripples are also prevalent (Crampton & Moore 1990). Calcareous and phosphatic concretions and pyrite nodules are locally common in the exposed strata. The upper part of the unit is highly fossiliferous and rich in finely comminuted plant material, slightly glauconitic near the top. A coarse pebble to cobble basal conglomerate 50-60 m thick containing blocks of greywacke, ripped-up sandstone clasts and minor lenses of carbonaceous mudstone and coal interfingers with the sandstone. The marine near shore, shallow sedimentary unit was deposited during subsidence, possibly onlapping over a dissected coastal plain and/or stacking of several minor transgressive and regressive cycles (Speden 1973; Crampton & Moore 1990). The unit rests unconformably on Mesozoic greywacke of the Urewera Group and is overlain conformably by Rakauora Mudstone (Whangai Formation).

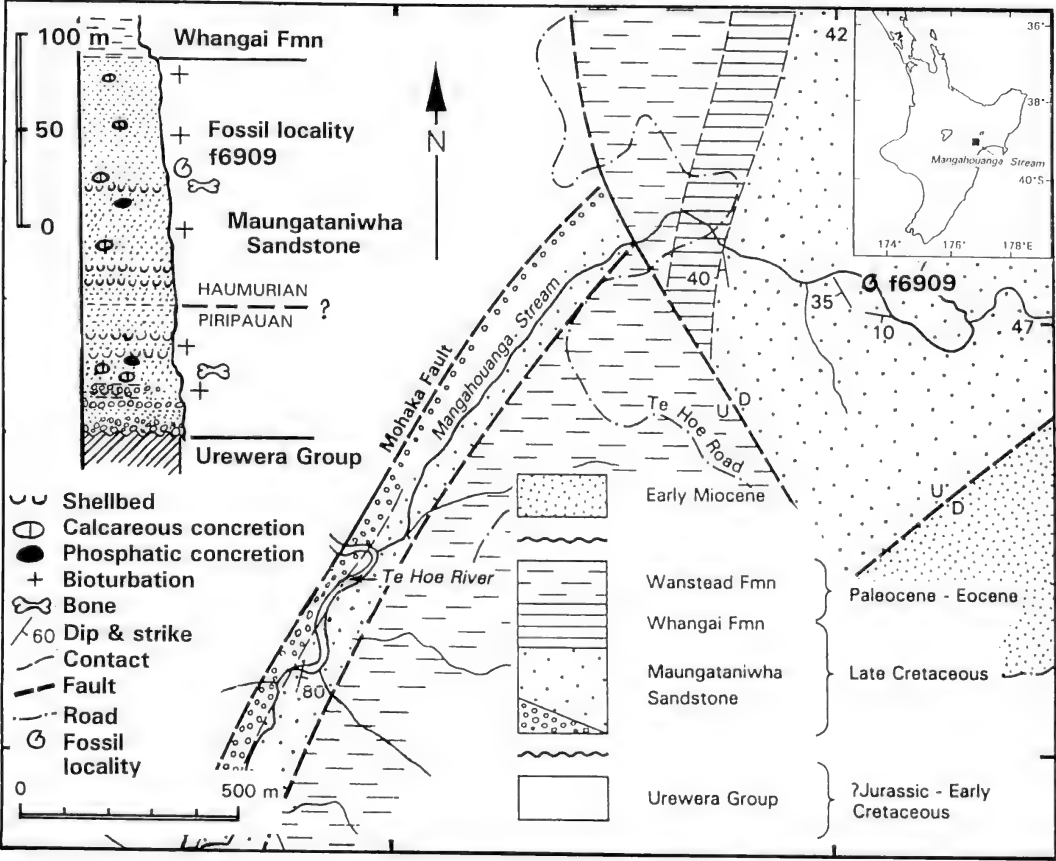


Fig. 1. Simplified geological map of Mangahouanga Stream, Te Hoe River, western Hawkes Bay, and stratigraphic column for the Mangataniwha Sandstone (modified after Crampton & Moore (1990).

SYSTEMATICS

- Class            CRINOIDEA Millar, 1821  
Subclass       ARTICULATA Zittel, 1879  
Order           ISOCCRINIDA Sieverts-Doreck, 1952
- Family          ISOCCRINIDAE Gislen, 1924

Articulate crinoids in which the articular face of the columnals has lanceolate to subguttiform petals surrounded by adradial and marginal crenellae. The crenellae attain their greatest length about the gradual transition from marginal to adradial position. The length of internodes is 6-17 internodals, with fewer located in the proximal region of the column. The nodals are larger than internodals with five large elliptical cirrus sockets facing outwards.

- Genus           *Isselocrinus* Rovereto, 1924

Type species: *Isselocrinus insculptus* Rovereto, 1924 (by monotypy). An incompletely known species thought perhaps to be a synonym of *Pentacrinus didactylus* D'Archiac, 1846 from the Oligocene of Italy.

Isocrinidae with stellate, pentagonal, pentalobate, or cylindrical column. A gradual transition from marginal to the adradial crenellae, as in *Isocrinus*, although these are often continued in short proximal adradial ridges. Nodals possess fewer than five cirri articulated to the lower edge and directed obliquely downwards. Theca large, forming a wide bowl. Two primibrachials, the second auxiliary. The articulations I Br 1-2 and Br 1-2 are synostosomal or cryptosyzygial. First pinnule is on II Br 1-2.

***Isselocrinus mangahouangaensis* n.sp. (Figs 2-4, 9)**

**MATERIAL**

Holotype. GS11359/EC904 (Institute of Geological and Nuclear Sciences), infranodal columnal, only the articular face of which is preserved as an external cast. Collected by Joan Wiffen, 1973 (*in situ*).

**TYPE LOCALITY AND AGE**

Maungataniwha Sandstone, Mangahouanga Stream, western Hawkes Bay. New Zealand Fossil Record File number V19/f6909, V19/420469-421469, the unit being dated as late Piripauan-Haumurian (Speden 1973). Separation of these two stages has proven complicated (Warren & Speden 1977), but Crampton & Moore (1990) suggest that the upper 200-250 m of the sandstone unit (which include this site), are correlated by palynology and molluscan macrofossils as early Haumurian.

**DESCRIPTION**

The infranodal columnal is rounded pentagonal in transverse section. Columnar diameter is 4.1 mm in the holotype. The axial canal is narrow, pentagonal, perilumen uninterrupted, smooth, porous. Columnar articular face possesses five regular, broadly elliptical, inter-radial petals, each surrounded by 18 culmina; petal areola smooth, slightly concave, porous; two-thirds of culmina are adradial with the rest reaching the periphery. Lateral peripheral and radial crenulation is evenly joined; proximal crenellae meet in the radius at an oblique angle; distal crenellae are separated by a large, smooth, triangular radial area; radial depressions exist at the suture; crenulation forms a curved margin along the distal area of the radius and along the periphery; crenellae reach their greatest length about the transition from adradial to peripheral position. The small rudimentary crenellae near the centre are nearly perpendicular to the radius and before termination, are reduced to granules; inferred articulation between nodal and infranodal is cryptosymplectical.

**ETYMOLOGY**

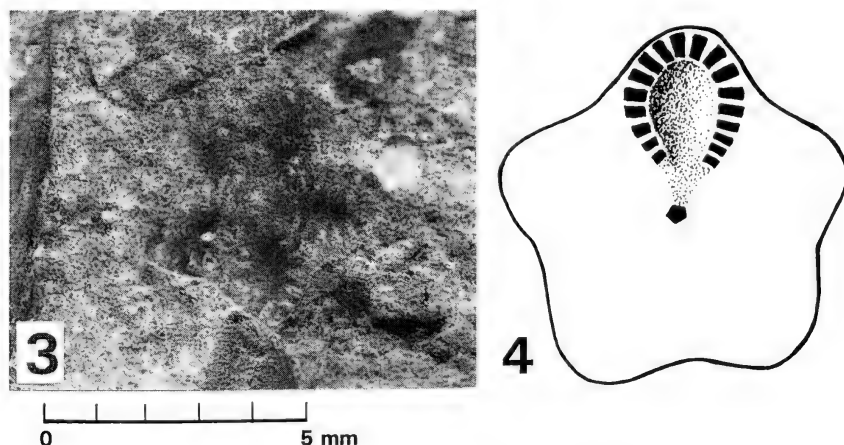
Named after the type locality, Mangahouanga Stream.



## DISCUSSION

The gradual transition from an articular face similar to that of *Balanocrinus* (with narrow adradial ridges and short, uniform, marginal crenellae) to one similar to that of *Isocrinus* (without adradial ridges, but with elliptic or subguttiform interrarial petals surrounded by radiating crenellae longest near the transition from marginal to adradial position), is inherent within a range of comparable *Isselocrinus* species. This variation is most pronounced in *I. paucicirrhus* (Fig. 6) and was the basis for Nielsen (1913) to disregard the taxonomic value of these characteristics and to unite the genera *Isocrinus* and *Balanocrinus* with *Pentacrinus*. Ontogeny in *Isselocrinus* columnals is reflected in a change from an *Isocrinus* articular face pattern to that of *Balanocrinus*; from a more or less pentalobate columnal outline to a more or less circular one (Rasmussen 1961).

Bather (1917) and Sieverts-Doreck (1944) studied *Isselocrinus* species, at the time deferred to *Balanocrinus*. Bather postulated that the *Balanocrinus* morphology arose several times from that of *Isocrinus* between the Triassic and Oligocene, stating that it thus did not constitute a homogeneous monophyletic genus. Bather further suggested that some species of *Balanocrinus*, if accepted as polyphyletic, should perhaps be regarded as a subgenus of *Isocrinus*. Rasmussen (1953) established a new genus, *Lipocrinus*, by separating this uniform and natural group existing within *Balanocrinus*. Rasmussen (1954) however, later synonymised the genus *Lipocrinus* with *Isselocrinus* even though this genus, without affecting the priority of the generic name, was established on the misinterpretation of a damaged column fragment (Rasmussen 1961). Rasmussen (1961) also stated that "separation of the species must generally be based on the form of the columnals, which alone are normally known." Historically, species of *Isselocrinus* are usually separated and described only by small differences in relative as well as absolute dimensions and the morphological plan of the articular face. Since the theca, brachials, pinnules and form of the column is unknown, only the plan of the articular face is a distinguishable feature in *Isselocrinus mangahouangaensis*.



Figs 3-4. *Isselocrinus mangahouangaensis* n. sp., Mangahouanga Stream, western Hawkes Bay. 3. Proximal view of the infranodal columnal articular face of the holotype EC904. 4. Infranodal columnal articular face diagram of the broad convex petal areolae, number of culmina, curved crenulation pattern and pentagonal axial canal. Diagrammatic only, no scale implied.

Earlier fossil lists from Mangahouanga Stream have recorded crinoid columnals but misplacement and the inaccessibility of private collections has precluded examination of these specimens.

The following Cretaceous and Tertiary *Isselocrinus* species were compared with *I. mangahouangaensis*: *I. stelliferus* (Hagenow, 1840); *I. peroni* (Loriol, 1893); *I. daniensis* (Valette, 1932); *I. groenlandicus* Rasmussen, 1961; *I. tibiensis* (Dupuy de Lome & Revilla, 1956); *I. dixonii* (Ooster, 1870); *I. bryani* (Gabbi, 1876); *I. paucicirrhus* (Nielsen, 1913); *I. buchii* (Romer, 1840); *I. africanus* (Loriol, 1893); *I. sundaicus* (Wanner, 1938); *I. lorioli* (Noell, 1900); *I. haitiensis* (Springer, 1925); *I. diaboli* (Bayan, 1908); *I. cubensis* (Valette in Roig, 1926); *I. subbasaltiformis* (Sowerby in Weatherell, 1837); *I. insculptus* Roverto, 1914; *I. inkermanensis* (Loriol, 1879); *I. didactylus* (D'Archiac, 1846); *I. dallonii* (Termier & Termier, 1949). From these, four Cretaceous species with columnal articular faces exhibiting morphological affinities have been chosen for detailed comparison to *I. mangahouangaensis* (Figs 5-8).

The columnals of the four comparative Cretaceous species *Isselocrinus stelliferus*, *I. paucicirrhus*, *I. peroni* and *I. bryani* are all larger than that of *I. mangahouangaensis* (Table 1). Unlike the rounded pentagonal infranodal columnal of *I. mangahouangaensis*, rare infranodal columnals of Maastrichtan *I. stelliferus* from the White Chalk of Kugan, Mon, Germany, and other European localities, are stellate, with sharp, straight edges and are rather high (1.2-1.6 mm). The articular face of the infranodal columnal of *I. mangahouangaensis*, as in all isocrinids, is characterised by five interrarial petals. In *I. mangahouangaensis*, these are broadly elliptical and each interrarial petal has 10 short crenellae along the periphery and 4 along each radius; a section totals 18 culmina. In contrast, the articular face of *I. stelliferus* has interrarial petals that are narrow and elliptical, with each section having 4-14 short crenellae along the periphery and from 0-2 along each radius; a total of 8-18 culmina. An indistinct adradial ridge divided by a radial furrow exists along the radius of *I. stelliferus* but is absent in *I. mangahouangaensis*. Both species exhibit petals with a distinctly porous areola that continues around the axial canal, which in *I. stelliferus* is circular but pentagonal in *I.*

Table 1. Comparative maximum measurements (mm) and meristics of the columnals of: *Isselocrinus mangahouangaensis* (A); *I. stelliferus* (B); *I. paucicirrhus* (C); *I. peroni* (D) and *I. bryani* (E).

<i>Isselocrinus</i> spp.	A	B	C	D	E
Columnal diameter	4.1	4.6	7.0	7.0	11.2
Interradius length	1.9	2.1	4.0	3.2	4.1
Radius length	1.1	1.5	3.7	3.0	3.9
Columnal height	-	1.6	2.2	2.6	0.9
Mean no. of peripheral crenellae per section	10	14	12	12	10
Mean no. of radial crenellae per section	4	2	5	10	1

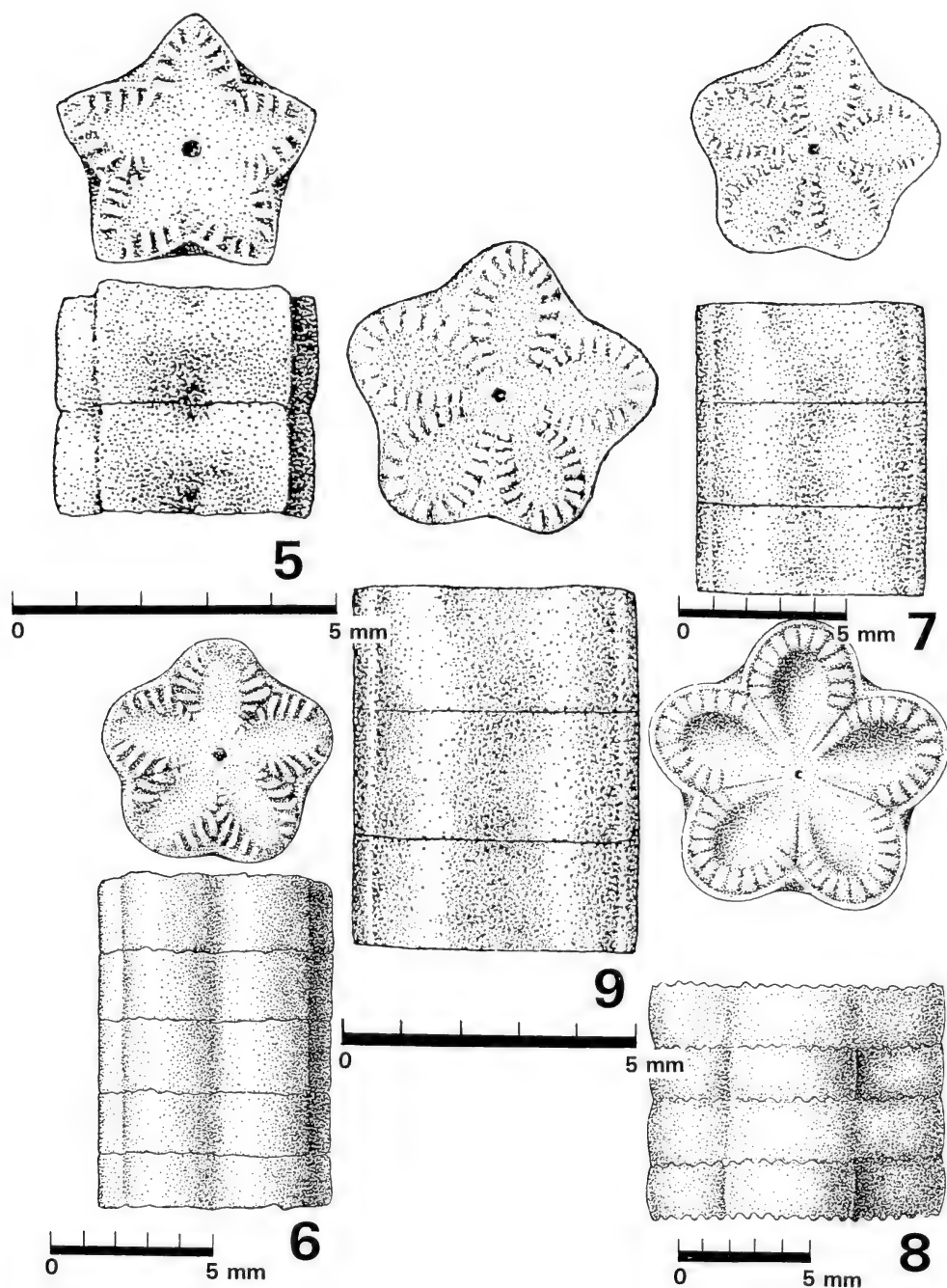
*mangahouangaensis*. The articulation between nodal and infranodal is almost smooth, cryptosymplectical in *I. stelliferus* and inferred to be similar in *I. mangahouangaensis*. No evidence of the number of cirri that have been articulated to the nodal are seen on infranodals of either *I. stelliferus* or *I. mangahouangaensis*.

Common lower Danian macrofossil internodal columnals of *Isselocrinus paucicirrhus* in Denmark and Sweden, are, by comparison, pentalobate and of similar height to *I. stelliferus* (0.9–2.3 mm). The internodal columnal articular face of *I. paucicirrhus* is characterised by five elongate, narrow, elliptical petals that have 12 short crenulae along the periphery and 5 along each radius and a total of 22 culmina. Although total culmina number the same per section as in *I. mangahouangaensis* and *I. stelliferus* the culmina petal pattern varies considerably from either. Both *I. paucicirrhus* and *I. mangahouangaensis* show the porous structure of the petals. Unlike *I. mangahouangaensis*, in *I. paucicirrhus* an indistinct double ridge along the radius is divided by a radial furrow. A further disparity between *I. mangahouangaensis* and *I. paucicirrhus* is the adradial ridge in *I. paucicirrhus* which is succeeded near the periphery by crenulae which form a curved margin along the distal part of the radius and periphery. The small rudimentary crenulae toward the axial canal are perpendicular to the radius as in *I. mangahouangaensis*, but unlike *I. mangahouangaensis*, the limits of the adradial ridges in *I. paucicirrhus* are parallel or outwardly diverging then soon disappear and are only then succeeded by crenellae. *I. mangahouangaensis* has no radial furrows or inferred radial pores whereas in *I. paucicirrhus* radial furrows continue to the periphery where they form a radial pore in the column suture. A smooth radial area exists in *I. mangahouangaensis* but not in *I. paucicirrhus*. *I. mangahouangaensis* and *I. paucicirrhus* possess pentagonal and narrow subpentagonal axial canals respectively. The articulation between nodal and infranodal in *I. paucicirrhus* is smooth synostosomal or faint cryptosymplectical; *I. mangahouangaensis* is inferred cryptosymplectical only. *I. stelliferus*, *I. paucicirrhus*, and *I. mangahouangaensis*, as in *Isocrinus*, all have crenellae with their greatest length near the radius, are reduced at the periphery and are separated from the column edge in the infranodal by a narrow, curved, smooth margin.

*Isselocrinus peroni* infranodal columnals are rare and are known only from the Senonian and Danian of Tunisia are distinctly pentagonal with rounded edges and vary in height (1.3–2.6 mm). *I. peroni* is the most similar species to *I. mangahouangaensis*. The articular face of *I. peroni* (with subguttiform interrarial petals) is up to 7 mm in diameter and possesses a suture that is non-crenulate. Like *I. mangahouangaensis*, the axial canal in *I. peroni* is narrow, pentagonal. Interrarial petals with porous areolae in *I. peroni*, differ from *I. mangahouangaensis* in that they are narrow and not broad, and possess more culmina per section (22 as distinct from 18) than in *I. mangahouangaensis*. In both *I. mangahouangaensis* and *I. peroni*, proximal crenellae meet in the radius at an oblique angle, but more distal crenellae are separated by a large smooth triangular radial area; crenulation reaches the edge of the columnal in both species only in the interrarial angle. Both *I. mangahouangaensis* and *I. peroni* possess areolae around the axial canal that are porous, however, this area is proportionately larger in *I. mangahouangaensis* than in *I. peroni* extending radially further outward. This morphological difference is possibly due to the reduced number of culmina per section. As in *I. mangahouangaensis*, crenulation in *I. peroni* reaches the edge of the columnal only in the interrarial angle; there is no evidence of radial pores in the suture of either species.

Danian internodal columnals of *Isselocrinus bryani*, known solely from New Jersey,





Figs 5-9. Proximal articular faces and lateral views of pluricolumnal stems of *Isselocrinurus* spp. 5. *I. stelliferus* (infranodal), Lower Maastrichtian, White Chalk of Rugen, Mon, Germany (neotype). 6. *I. paucicirrhus* (internodal), Lower Danian, Kagstrup, Denmark (lectotype). 7. *I. peroni* (infranodal), Senonian, Guelaat-es-snam, Tunisia (lectotype). 8. *I. bryani* (internodal), Danian, Vincetown Limesand, New Jersey, U.S.A. (holotype). 9. *I. mangahouangaensis* n. sp. (reconstructed infranodal from holotype). (Figs 5-8 from Rasmussen (1961)).



United States of America, are rounded pentalobate with a low profile (0.5–0.9 mm). *I. bryani*, like *I. mangahouangaensis* has wide subguttiform petals, and short, rather uniform crenellae. The difference between the two species other than the larger size, is the presence of radial ridges in *I. bryani* and only 13 culmina (10 along the periphery and one along each radius) within each section. *I. mangahouangaensis* may not have a crenulate suture, but *I. bryani* does.

The infranodal columnal of *Isselocrinus mangahouangaensis* is distinctly different from all other species of the genus because of a differing articular face, interradianal petal pattern, number and orientation of culmina, large areola area surrounding the axial canal and large triangular radial area. The rarity of *I. mangahouangaensis* ossicles and absence of pluricolumnals does not suggest death *in situ*. However, the articular face of the holotype is relatively sharp in detail, suggesting little transportation in a low-energy, marine environment (Speden 1973). Since all Isocrinida enjoyed a wide environmental range in the early Cretaceous, the presence of another benthic, semi-sessile, articulate crinoid in shallow water near shore facies proves that isocrinids were prevalent in this New Zealand paleoenvironment during both the Mesozoic and Cenozoic (Eagle 1993; Eagle & Hayward 1993). Because of similarities to European *Isselocrinus* species, it is suggested that *I. mangahouangaensis* is a Mesozoic remnant of a Tethyan fauna that migrated to New Zealand before or during the Cretaceous.

#### FAUNAL ASSOCIATIONS AND PALEOENVIRONMENT (Fig. 2)

Crampton & Moore (1990) list the fossil macrofauna from the Maungataniwha Sandstone in the region of Mangahouanga Stream. The fauna is that of an upper Cretaceous fine grained, bioturbated, muddy-sandy bottom and a representative selection is illustrated (Fig. 2). The assemblage includes a high proportion of detritus-feeding and burrowing taxa diagnostic of a near shore, low energy environment of 10–50 m, i.e. innershelf. Crampton & Moore (1990) state: “inferred feeding habits and substrate niches of the fauna, and the abundance of adult and juvenile marine reptiles, suggest an estuary, bay or inlet setting”.

*Inoceramus* (sensu lato) *matotorus*, *I.* (s.l.) *australis* and *I.* (s.l.) *pacificus* were particularly common living in clusters attached by byssal threads to each other and to shell debris. Infaunal elements include the deep burrower *Panopea malvernensis*, the costate *Pterotrigonia pseudocaudata*, the asiphonate *Cucullaea* (*Cucullastis*) *zealandica* and the siphonate *Neilo cymbula*. The epifaunal pectinid bivalve *Aequipecten* is also present with the free-living, perhaps occasionally swimming, smooth, sub-circular *Entolium membranaceum*. Gastropods seem not to have been as abundant as bivalves in this biotope; *Turbo* was probably an algal grazer, Aporrhaidae are ciliary feeders on fine deposits and *Natica ingrata* a carnivore. Infaunal scaphopods are represented by *Dentalium* cf. *morganianum*. The only brachiopod known from this community is a burrowing *Lingula* sp. *Isselocrinus mangahouangaensis* n. sp. is a typical semi-sessile, benthic isocrinid which probably lived attached to any hard substrate where minimal currents provided both food and oxygen to the passive filter feeder. Epifaunal decapods such as *Eodorippe spedeni* and *Haumuriaegla glaessneri* existed on the soft substrate. Intensive bioturbation, with trace-fossils such as knobbly mud-lined *Ophiomorpha*, *Planolites* oriented oblique to bedding, and *Chondrites*, indicate the presence of diverse arthropods and polychaetes.

A diverse nektonic carnivore fauna consisting of the osteichthyan *Pachyrhizodus caninis*, many cephalopods (the nautiloid *Cimomia* sp., and several genera of ammonites

including the normally coiled *Tetragonites simplex*, *Kossmaticeras* (*Natalites*) sp. and *Anagaudryceras subsacya*; *Dimitobelus hectori*, *D. lindsayi*, and *D. ongleyi* representing the Belemnoida) existed in the biotope. Toothless, beaked protostegid sea turtles paddled in the vicinity. Chondrichthyan fauna such as *Carcharias* sp., *Isurus mantelli* and *Callorhynchus hectori* may have made regular incursions through the biotope. Marine saurians such as *Moanasaurus mangahouangae*, Elasmosauridae sp. and Pliosauridae sp. were also vagrant occupants. Remnants of Boreal genera merge into a Tethyan association within this southern Pacific assemblage.

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M.K. EAGLE, c/o Auckland Institute and Museum, Private Bag 92018, Auckland.

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# EARLY MIOCENE ROCKY SHORE AND COARSE SEDIMENT FOSSIL COMMUNITIES, KAWAU ISLAND, AUCKLAND

MICHAEL K. EAGLE, BRUCE W. HAYWARD AND GLENN CARTER

*Abstract.* Eighty-four macrofossil taxa (including 43 molluscs, nine echinoids, eight chordates, and three each of barnacles, corals and brachiopods) are recorded from the Kawau Subgroup at Fossil Point, Bostaquet Bay, Kawau Island, north of Auckland city. Nineteen species of foraminifera (shelled Protozoa) are recorded from two microfossil samples from the associated strata. The fossil faunas confirm an early Miocene (Otaian stage) age.

The macrofauna is inferred to contain a mixture from three communities. Nearly half the fauna (e.g. *Sarmaturbo*, *Haliotis*, *Cookia*, *Cellana*, *Crenostrea*, hermatypic corals, some *in situ*), is derived from a subtidal rocky shore and coarse gravel community that probably lived at 0-20 m depth. Most of the rest of the macrofauna, as well as the foraminiferal microfauna is an *in situ*, inner shelf sand community that lived in a moderately exposed paleobay at inferred depths of 10-30 m. Also present are macrofossils that are inferred to have floated or washed in from the surrounding rocky shoreline, from a nearby estuary and from the nektonic fauna that lived farther out to sea.

## PREVIOUS WORK

The geology and stratigraphy of the early Miocene rocks on Kawau Island have been mapped and/or described by Cox (1882), Park (1886), Ferrar (1934), Hopgood (1961), Wood (1976), Hayward & Brook (1984) and Ricketts *et al.* (1989).

Buchanan (1870) recorded six of the more common mollusc genera from the fossil fauna within the sequence at Fossil Point, Bostaquet Bay. Later, Powell (1938) recorded fifteen species of mollusc from Bostaquet Bay, including descriptions of three new species of shallow rocky shore molluscs - two *Haliotis* and one *Cookia*.

## GEOLOGY (Fig. 1)

Kawau Island is composed of Permian to Jurassic Waipapa Group greywacke basement unconformably overlain in places by the eroded remnants of an early Miocene transgressive sequence (basal Waitemata Group). This sequence progressively buries an irregular coastal topography of actively eroding greywacke stacks, cliffs and embayed islands (Ricketts *et al.* 1989).

The basal Waitemata Group rocks (Kawau Subgroup, Cape Rodney Formation - Hayward & Brook (1984)) on Kawau Island exhibit different transgressive sequences in different areas or paleobays. Fossil Point in Bostaquet Bay was chosen for this study because

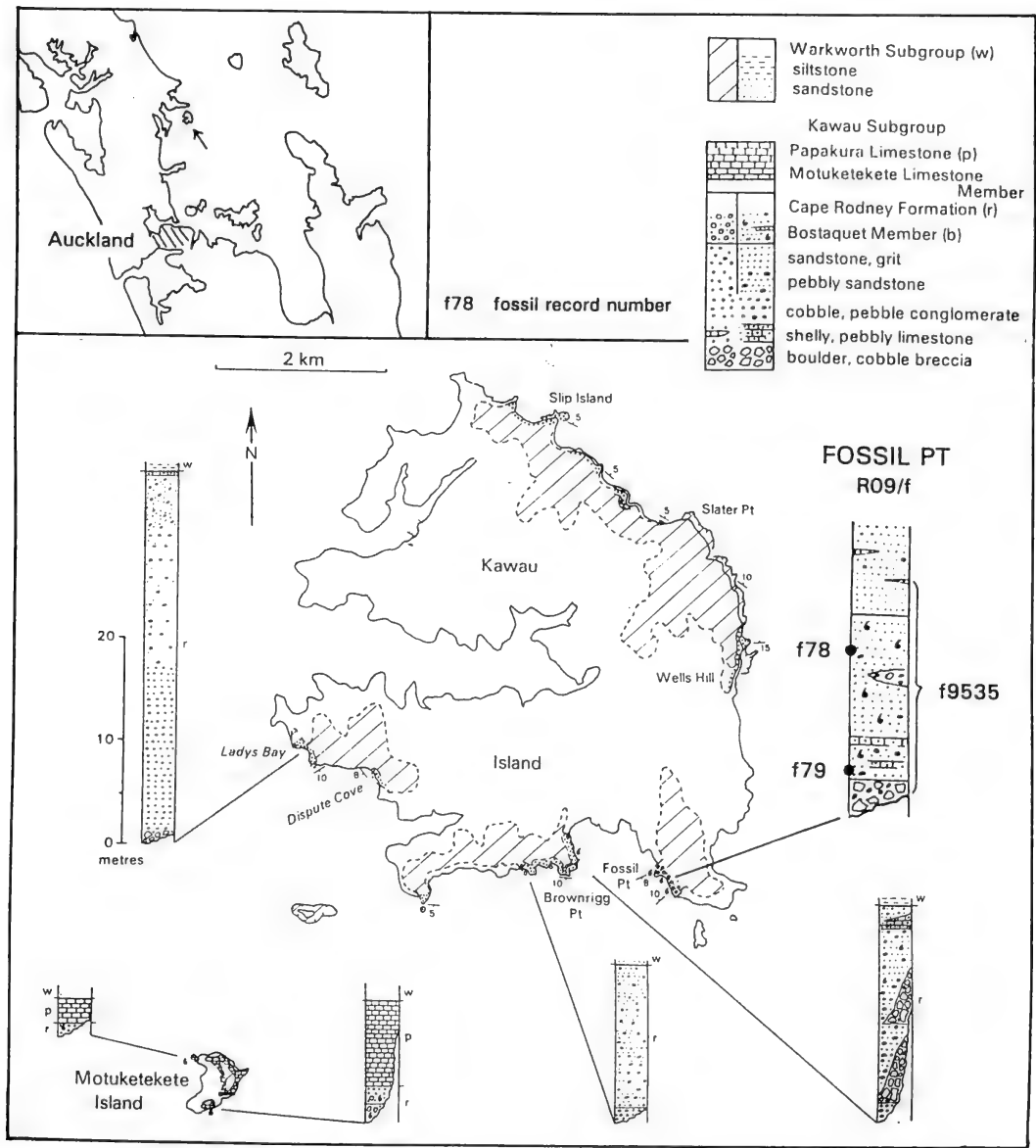


Fig. 1. Geological map of Kawau Island, with stratigraphic column for the early Miocene Kawau Subgroup in eastern Bostaquet Bay (after Hayward & Brook 1984).

of its rich macrofossil content in an uncommon sandy calcareous facies (Bostaquet Member - Hayward & Brook (1984)).

Around Fossil Point, the Kawau Subgroup fills a small paleobay, about 200 m across. Subsequent compaction has produced a shallow syncline within the paleobay, with the 14 m thick sequence sloping up and onto the greywacke on either side. The sequence (Fig. 1)

consists of 1-2 m of calcite-cemented, angular to subrounded, boulder, cobble breccia sitting directly on the greywacke. This is overlain by 2 m of slightly shelly, medium sandstone with cemented bands of shelly, pebbly limestone, which passes up into 10 m of calcareous, shelly, slightly carbonaceous, medium sandstone with rare pebble or cobble horizons. This unit is the local top to the sequence, but elsewhere around Kawait and on nearby Motuketekete Island, the gravelly and sandy Kawait Subgroup sequence is abruptly but conformably overlain by massive mudstone then flysch of the deep water Warkworth Subgroup (Hayward & Brook 1984).

In this paper, we focus on the paleontology of the Bostaquet Member at Fossil Point, Kawait Island. The macrofossil fauna listed here is based on several collecting trips carried out jointly and separately by all the authors between 1991 and 1994, combined with additional records of rarer fossils found by several colleagues or held in the collections of the Auckland Institute and Museum (collected by A.W.B. Powell). In this paper, we provide the first updated published list of the macrofauna since Powell (1938), a foraminiferal species list, and the first interpretation of the paleoenvironment as provided by the fossil faunas.

Fossil Record Numbers are those of the New Zealand Fossil Record File (prefixed by R09). All macrofossils are held in the collections of Auckland Institute and Museum (unless otherwise specified in Appendix 1) and all microfossils are held by the Institute of Geological and Nuclear Sciences, Lower Hutt.

## MACROFAUNA

All collected taxa are listed in Appendix 1. The paleontological and paleoenvironmental assessment that follows is largely based on the known ecology of genera living today and of modern species most closely related morphologically to these fossils.

The diverse fossil macrofauna collected from the calcareous sandstone facies unit at Bostaquet Bay consists of many broken and disarticulated specimens. Minor pre-burial transport probably accounts for both breakage and disarticulation. Calcium carbonate recrystallization is present in all fossils found here. Prolonged leaching and weathering of specimens has occurred as the coastal exposures are not subject to rapid erosion. Structural and compactional deformation of the rocks has compressed some fossil specimens, flattening gastropods and distorting bivalves.

Analysis of the macrofossil fauna from Fossil Point (R09/f9539) has enabled us to recognise that it is composed of elements from three communities. Each is discussed separately below.

### SUBTIDAL ROCKY SHORE AND COARSE GRAVEL COMMUNITY, 0-20 m (Fig. 2)

Nearly half (29 species) the Fossil Point fossil assemblage is the remains of organisms that are inferred to have lived in a shallow subtidal rocky reef habitat (c. 0-20 m). Epifaunal rocky reef inhabiting gastropods include the limpet *Cellana*, the large turbin *Sarmaturbo*, the carnivorous *Conus* and *Conolithes* and, living beneath stones and ledges browsing upon coralline and other algae, *Haliotis* and *Cookia*.

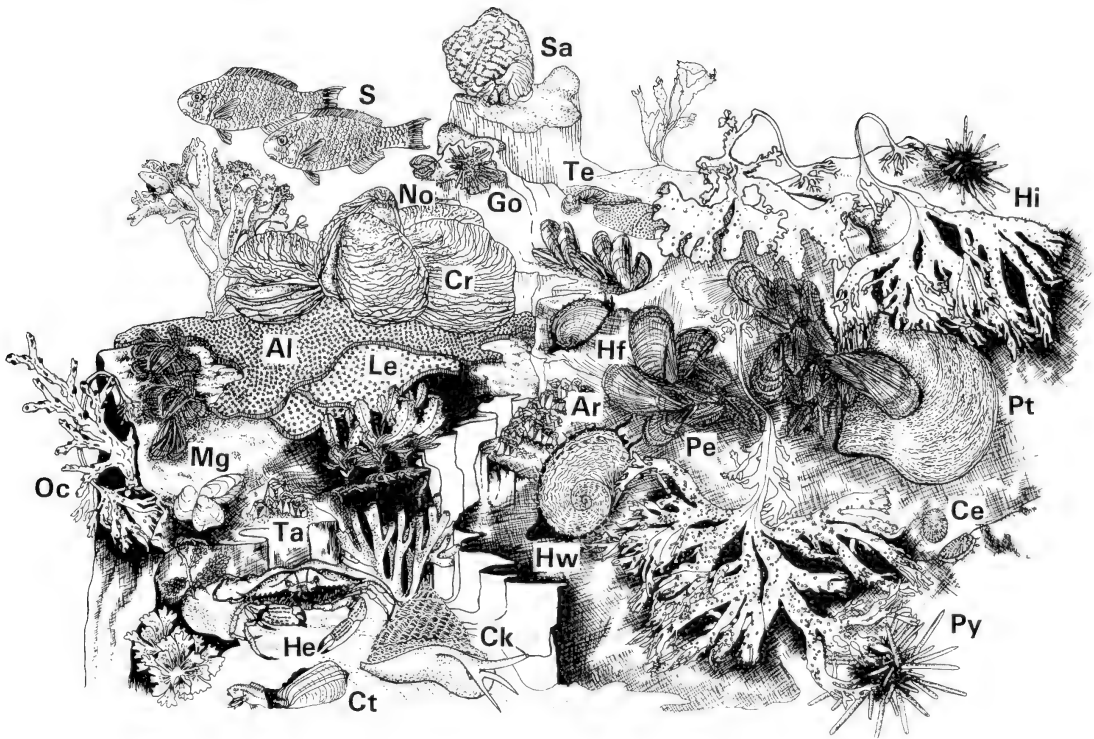


Fig. 2. Schematic drawing of the *in situ* intertidal and shallow subtidal rock and coarse gravel community (0-5m) at Fossil Point, Bostaquet Bay, Kawau Island. Al= *Alveopora polycanthus*; Ar= *Armatobalanus motuketeketeensis*; Ce= *Cellana thomsoni*; Ck= *Cookia kawauensis*; Cr= *Crenostrea gittosina*; Ct= *Conus* (sensu lato) *thorae*; Go= *Goniocidaris pusilla*; Hf= *Haliotis* (*Sulculus*) *flemingi*; He= *Hemiplax* sp.; Hi= *Histocidaris mackayi*; Hw= *Haliotis* (*Notohaliotis*) *waitemataensis*; Le= *Leptastrea* sp.; Mg= *Magasella neozelandica*; No= *Notosaria antipoda*; Oc= *Oculina virgosa*; Pe= *Perna tetleyi*; Pt= *Pteria oneroaensis*; Py= *Phyllacanthus titan*; S= *Sargus laticonus*; Sa= *Sarmaturbo superbus*; Ta= *Tasmanobalanus grantmackieii*; Te= *Terebratulina suessi*. No scale implied. (Hw, after Beu *et al.* 1990).

In the same community, nestling in cracks, under ledges, or in cavities lived other algal grazers such as cidarid echinoids. Interambulacral plates and spines show that *Goniocidaris*, *Histocidaris* and the large subtropical *Phyllacanthus* lived in this community. Complete tests of undescribed species of Australian tropical genera now extinct to New Zealand include *Arbia*, *Phymechinus*, *Stereoepedina* and *Schizechinus*.

Sheets of the hermatypic corals *Alveopora* and *Leptastrea* grew on coarse, gravelly substrate or rocky reefs. Some of the coral sheets occur in growth position on the basal greywacke substrate and in the gravels just above it, at the south end of the Fossil Point outcrop of Kawau Subgroup. The ahermatypic coral *Oculina*, usually found living today somewhat deeper than 15 m, is also present in this assemblage.

The sessile, filter-feeding brachiopods *Magasella*, *Notosaria*, and *Terebratulina* are inferred to have occupied this hard substrate, either beneath rocks or under overhangs. Also



present were the sedentary byssate bivalves *Perna* and *Pteria* along with the barnacles *Armatobalanus*, *Notobalanus* and *Tasmanobalanus* which lived attached to the rocky substrate or mollusc shells. A chela of the crab *Hemiplax* is the only evidence of any decapod Crustacea. This crab probably resided in narrow crevices or beneath stones.

Beak-like teeth found at this site belonged to a representative of the Scaridae family, *Sargus*, a parrot fish that is inferred to have lived in this community and probably included coral polyps in its diet. Parrot fish live today at depths of 0-50 m in tropical and subtropical seas.

Specimens of the large oyster *Crenostrea* are common. Many are bored by worms and sponges. The borings of pholad molluscs (ichnofossil genus *Trypanites*) occur in the greywacke bedrock and cobbles but no shells were seen. Lumps of enveloping, laminate, coralline algae (rhodoliths) are also common. Various indeterminate Bryozoa encrust empty mollusc shells or pebbles. The fauna described above probably lived amongst hydroids, seaweeds, annelids, sponges and tunicates, none of which is usually fossilised.

The paleoenvironment in which this community lived is inferred to have been just offshore from a moderately exposed, rocky and bouldery coastline with paleo-water depths of 0-20 m. It was probably exposed to oceanic swell and periodically high wave action.

#### SHALLOW INNER SHELF SAND COMMUNITY, 10-30 m (Fig. 3)

At least 30 species in the Fossil Point macrofauna are inferred to have lived in or on soft sandy sediment at inner shelf depths. The fauna is dominated numerically by shallow burrowing, suspension-feeding bivalves such as *Dosinia*.

The byssate, pectinid *Chlamys* may have lived attached to the underside of rocks or enmeshed in sponges. *Lima*, *Mesopeplum* and extinct *Lentipeecten* were freely mobile bivalves in this biotope, like the modern New Zealand *L. colorata zelandica* and *M. convexum*. An important element was the large lucinid *Miltha*, which typically inhabits shellbeds in soft, shallow water substrates such as this. The lucinid, *Divaricella huttoniana* probably also lived in this community, as it does in New Zealand today (Powell 1979). Another large, inflated, thin-shelled, filter-feeding bivalve resident in this community was the New Zealand endemic genus *Hedecardium*. The golden oyster, *Anomia* is also inferred to have lived here.

Many infaunal deposit-feeding bivalves are present, including the long divergent-siphonate genera "*Tellina*" and *Bartrumia*, the fragile, thin-shelled *Offadesma* and the relatively large, elongate carditid *Megacardita* and the glycymerid *Tucetona*. Like the extant Australian species which are primarily inner shelf dwellers (Beu *et al.* 1990), the thick-shelled *Eucrassatella* occurring in this fossil assemblage may have been under constant threat of surf-churned eviction.

Of the gastropods, the ciliary deposit-feeding turritellids *Maoricolpus* and *Tropicolpus* were prominent members of this community, together with the circular-saw shell *Astraea*, specimens of which are commonly dredged on the inner-mid shelf all round New Zealand today (Powell 1979). *Struthiolaria* was another infaunal ciliary-feeding gastropod in this community. The deposit-feeding infaunal scaphopods *Antalis*, *Dentalium* and *Fissidentalium*, are also inferred to have lived in this community.

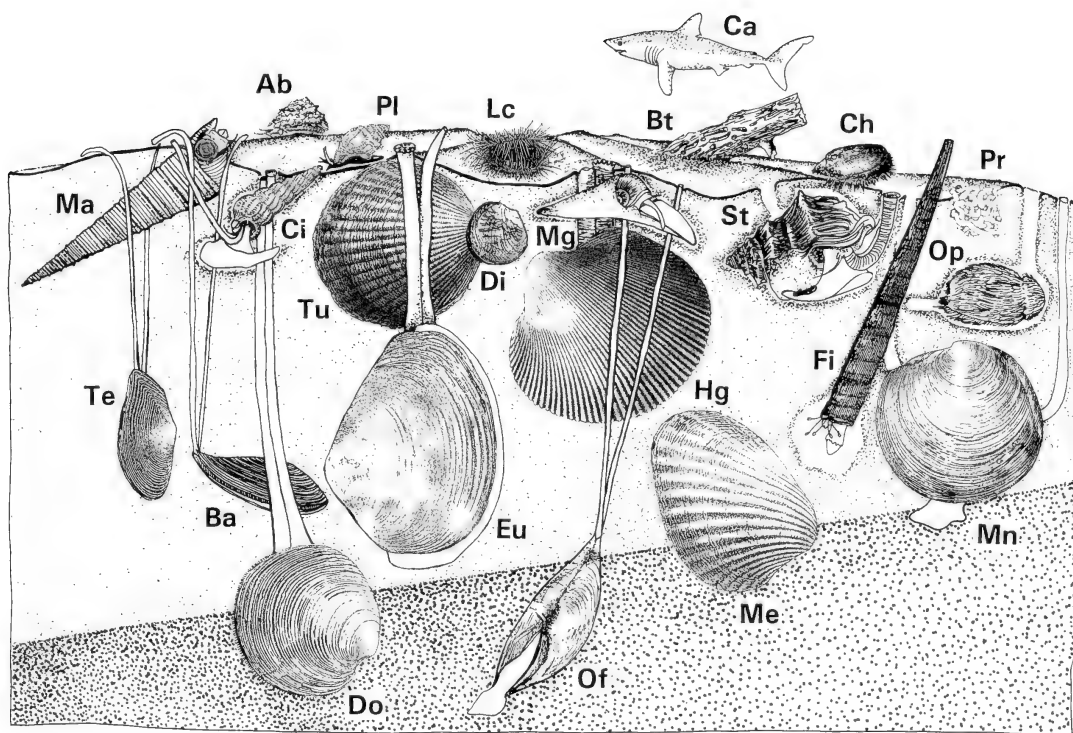


Fig. 3. Schematic drawing of the *in situ* shallow subtidal sand community (0–20 m) at Fossil Point, Bostaquet Bay, Kawau Island. Ab= *Astraea bicarinata*; Ba= *Bartrumia oneroaensis*; Bt= *Bankia turneri*; Ca= *Carcharias taurus*; Ch= *Chlamys fischeri*; Ci= *Cirsotrema firmatum*; Di= *Divaricella (Divalucina) huttoniana*; Do= *Dosinia (Raina) bensoni*; Eu= *Eucrassatella ampla*; Fi= *Fissidentalium* n.sp.; Hg= *Hedecardium (Titanocardium) greyi*; Lc= *Lima colorata*; Ma= *Maoricolpus waitemataensis*; Me= *Megacardita squadronensis*; Mg= *Magnatica (Spelaenacca) waitemataensis*; Mn= *Miltha neozelanica*; Of= *Offadesma angasi*; Op= *Opissaster rotundatus*; Pl= *Paracominia lignaria*; Pr= *Protula* cf. *tubularia*; St= *Struthiolaria lawsi*; Te= “*Tellina*” *hesternia*; Tu= *Tucetona auklandica*. No scale implied. (Ab, Ci, Do, Eu, Fi, Hg, Me, Mi, Pl, Te, Tu after Beu *et al.* 1990; Ma, Mg, Op, St after Morton & Miller 1968).

The limpet-like gastropod *Zegalerus* probably attached itself to empty bivalve shells or rocks. The globular, infaunal carnivore *Magnatica* (*Spelaenacca*) would have preyed on the burrowing molluscs present by drilling holes and inserting a fine proboscis to draw out the flesh. *Cirsotrema* probably lived suctorially upon anemones as does the similar recent epitoniid, *Epitonium jukesianum* (Morton & Miller 1968). The tropical to subtropical gastropod *Morum* (*Oniscidia*) would have been an active burrowing predator. Extant species of the turrid *Borsonia* are bathyal, but fossil species, as found here, are thought to have mostly lived in shallower water.

The free or attached serpulid *Protula*, was found in living orientation partly buried in sediment with its erect anterior tubes protruding. Like the recent New Zealand echinoderm

*Echinocardium*, the spatangoid *Opissaster* and the extant Australian *Echinoneus* were probably infaunal deposit-feeders in this community.

*Carcharias*, like the white-pointer shark of today, probably cruised inshore from time to time in search of prey or carrion. Ichnofossils are common in the sandstone and include the complex grazing traces of *Nereites*, Domichnia structures such as *Skolithos* and *Repichnia Cruziana* structures.

This community is inferred to have lived in slightly shelly, medium sand in a moderately exposed location at shallow inner shelf depths of about 10-30 m.

#### NEKTONIC AND OTHER EXOTIC FAUNA (Fig. 4)

Teeth, bones and floating shells are the scattered evidence of the nektonic fauna that lived in oceanic water beyond the immediate vicinity of the fossil locality. A possible turtle bone and the rib of an indeterminate small cetacean confirm the presence of these vertebrates in this domain.

An isolated mammalian tooth was also discovered at this site. Dr R.E. Fordyce (pers. comm. 18 April 1994) states that it "is an isolated cheek-tooth from a cetacean ... This tooth is a close match to some Oligocene-early Miocene specimens from New Zealand and from the USA which appear to be archaic heterodont mysticetes - Suborder Mysticeti ... but at present I cannot completely rule out that it is an archaic odontocete (Suborder Odontoceti) or possibly a relict archaeocete (Suborder Archaeoceti) ... the tooth is probably a lower right molar equivalent ... The lack of roots ... suggests that the fossil may be a deciduous (milk) tooth." Fossil teeth with slender lateral cusps from the cosmopolitan sand shark *Odontaspis* are also present, together with a tooth from a species of *Isurus* - a fast swimming, large (6 m) mackerel shark.

A small uncrushed, mature specimen of the nautiloid *Aturia* was found with unusually good preservation (Fig. 7). Because of internal gas-filled chambers, dead cephalopod shells float well at the sea surface and may travel great distances in this manner. Well-preserved shells of nautiloids occur over a very much wider area than that occupied by living specimens (Beu 1973). Thus this fossil *Aturia* has probably floated in from its offshore community, maybe hundreds of kilometres away.

Much carbonaceous material in the form of fossil wood and leaves occurs in the Fossil Point sandstone. The wood is probably sunk flotsam originating from nearby land. Some pieces are bored with long, cylindrical burrows c. 5 mm wide going obliquely into the wood then turning to follow the grain. Tunnels are coated with a thin layer of calcium carbonate, and in places much of the wood has decayed and all that remains are the shelly plates and fulcra of the teredo (*Bankia*) and the calcareous tunnel linings.

Fossil leaves of *Laurophyllum*, *Nothofagus* and ?*Metrosideros* are from either marginal estuarine or coastal cliff trees on nearby land. The leaves have washed into the sea and when waterlogged, sunk to the bottom and have been buried by sand. The carnivorous gastropod *Paracomina* and deposit feeder *Pyraxus* may also be transported elements from a sheltered, nearby estuarine environment.

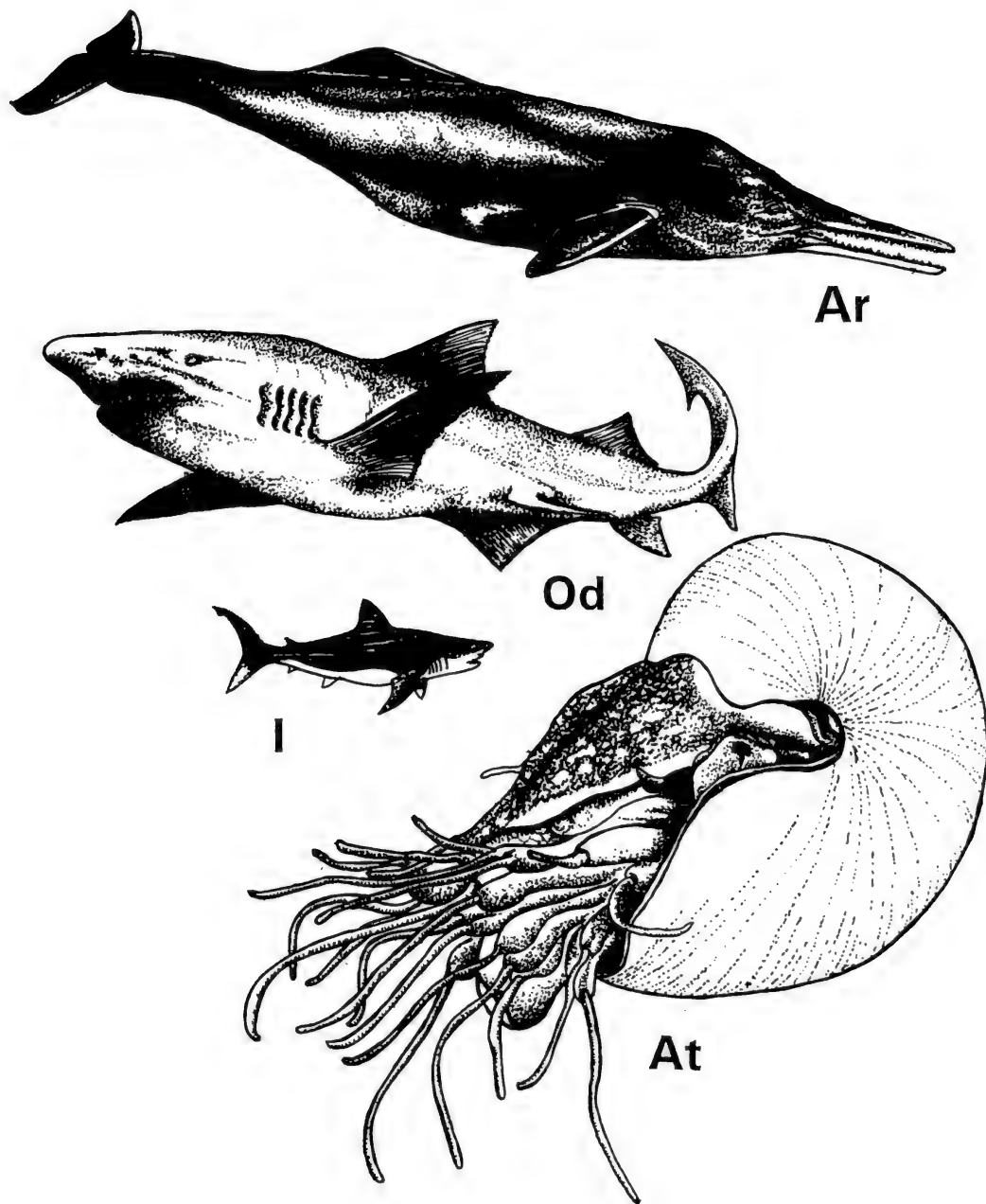


Fig. 4. Schematic drawing of the nektonic fauna transported in to the fossil assemblage at Fossil Point, Bostaquet Bay, Kawau Island. Ar= archaic cetacean; At= *Aturia cubaensis*; I= *Isurus desori*; Od= *Odontaspis elegans*. No scale implied.

## RARE OR UNUSUAL TAXA

The Fossil Point, Kawau Island fossil fauna contains many unusual shallow-water molluscs derived from a seldom preserved early Miocene rocky shore community. Faunal elements are similar to those identified from shallow, Oligocene rocky shore facies at Mt. Luxmore, Fiordland (Lee *et al.* 1983), Castle Hill Basin and Mason River, North Canterbury (Beu *et al.* 1990), and in the similar early Miocene basal Waitemata facies on Waiheke Island (Powell 1938). Some of these molluscs present in Fossil Point fauna are *Pteria oneroaensis*, *Miltha neozelanica*, *Bartrumia oneroaensis*, *Dosinia* (Raina) *bensoni*, *Offadesma angasi*, *Sarmaturbo superbus*, *Maoricolpus waitematensis*, *Tropicolpus tetleyi*, *T. (Amplicolpus) gittosinus*, *Struthiolaria lawsi* and *Morum* (*Oniscidia*) *harpaforme*. Fossil Point is the type locality of the rare species *Haliotis* (*Notohaliotis*) *waitemataensis*, *H. (Sulculus) flemingi* and *Cookia kawauensis*.

At Fossil Point the largest *in situ* heads or sheets (1.2 m x 0.6 m) of reef corals (Fig. 5) so far recorded in New Zealand (cf. Hayward & Brook 1981) are present.

Other unusual records for the early Miocene of New Zealand are the tooth of a large archaic cetacean (Fig. 6), the rib of a small fossil cetacean and a possible turtle bone. Also present are apparently undescribed species of the echinoids *Arbia*, *Phymechinus*, *Stereoepedina*, *Schizechinus* and *Echinoneus*.

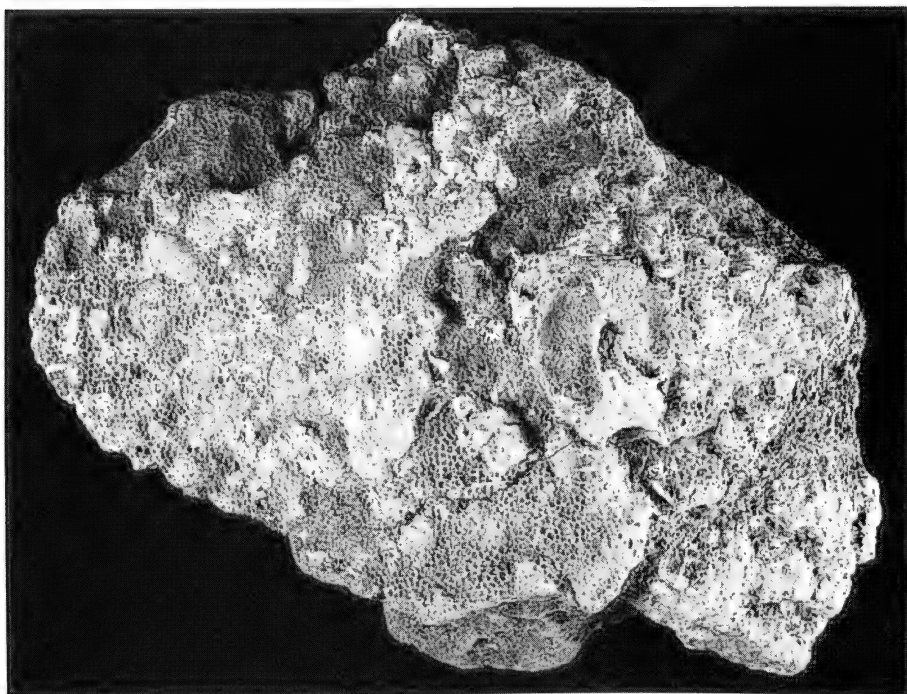
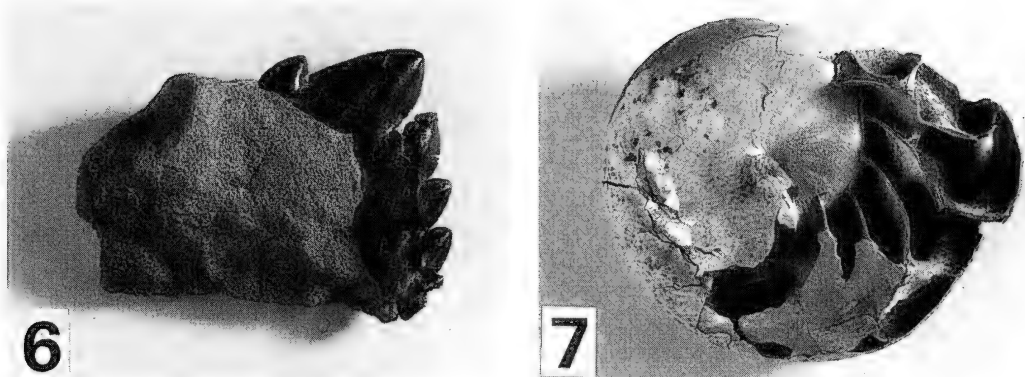


Fig. 5. Float boulder of *Alveopora* coral sheet (AK84700) from Fossil Point, Kawau Island. Length = 28 cm.



Figs 6-7. Specimens from Fossil Point, Kawau Island. 6. Archaic cetacean tooth (AK87193) showing labial detail. Width = 3.2 cm. 7. *Aturia cubaensis* (AK87192) showing excellent state of preservation. Diameter = 4.5 cm.

## MICROFAUNA

Two samples of finer-grained rock (medium sandstone) from within the Fossil Point sequence (R09/f78, f79) were disaggregated and a quantitative pick of 100 benthic foraminifera was made, identified and counted (Appendix 2). Both produced moderately rich, poorly preserved, recrystallised foraminiferal faunas. They contain low planktic foraminiferal numbers (1-2%), which indicate nearshore neritic waters overhead.

The benthic faunas of both samples are remarkably similar and are dominated by *Elphidium gibsoni* and robust *Amphistegina aucklandica*, with subdominant *Cibicides mediocris*, *C. temperatus* and *Gaudryina convexa*. Today large *Amphistegina*, *Elphidium* and *Gaudryina* are dominant members of foraminiferal faunas in high energy, coarse sediment at shallow inner shelf depths with normal salinity in subtropical areas. *Cibicides* has a wider environmental tolerance but does occur with these other three genera. Other species present in the fossil faunas that are considered to be inner shelf-restricted are *Cribrorotalia ornatissimum* and *Quasibolivina finlayi* (Hayward 1986). The total fauna is consistent with a paleoenvironment on an exposed coast at shallow inner shelf depths (2-30 m). This is similar to association C (*Cribrorotalia ornatissimum* - *Elphidium gibsoni* - *Cibicides mediocris*) from the early Miocene basal Waitemata sequence on Waiheke Island (Hayward & Brook 1994).

## AGE

### MACROFAUNAL EVIDENCE

The bivalve genera *Bartrumia* and *Perna* make their first known appearance in New Zealand in the Otaian stage of the early Miocene, as do the species *Lima colorata*, *Lentipecten* n.sp. aff. *hochstetteri* and the cephalopod *Aturia cubaensis*. The bivalves *Megacardita* and *Lentipecten hochstetteri* (sensu stricto), have their last known appearance in the Otaian. The presence of the gastropod species *Tropicolpus* (*Amplicolpus*) *gittosinus*, *Tropicolpus tetleyi*, *Sarmaturbo superbus*, and *Struthiolaria lawsi*, which are known only from the Otaian, confirms this early Miocene age.

## MICROFAUNAL EVIDENCE

The two shallow water foraminiferal faunas from Fossil Point contain no taxa that are stage specific for determining the age of the sequence. Occasional rare foraminifera in similar basal Waitemata (Kawau Subgroup) strata nearby on Kawau and Motuketekete Islands and subsurface at Orewa provide a fairly accurate assessment of the age of the Fossil Point sequence. The presence in these nearby sections of *Ehrenbergina marwicki* (Otaian-Altonian) on Motuketekete (R09/f74), *Catapsydrax dissimilis* (Duntroonian-Otaian) on Kawau Island (R09/f68, f76) and Motuketekete Island (R09/f74), and *Haesslerella hectori* (Waitakian-Otaian) in the Orewa Drillhole (R10/f13, cuttings 825-826.9 m) indicate an Otaian (early Miocene) age, which is the accepted age for all of the Kawau and overlying Warkworth Subgroups in the Waitemata Group (Hayward & Brook 1984, Hayward 1993).

The combined macrofaunal and microfaunal evidence gives an early Miocene, Otaian age (c. 22-19 million years old).

## PALEOENVIRONMENT AND PALEOGEOGRAPHY

In the Fossil Point sequence, the basal 1-2 m of greywacke breccia contains macrofossils (e.g. *Sarmaturbo*, *Haliotis*, *Crenostrea*, hermatypic corals *in situ*) that belong entirely to our "subtidal rocky shore and coarse gravel community" (described earlier). From this we infer that the basal breccia accumulated as cobbly gravel in 0-20 m depths around the moderately exposed, rocky coast of a paleobay.

The overlying 12 m of slightly shelly, medium sandstone that fills the paleobay at Fossil Point contains a foraminiferal microfauna that lived in sand on an exposed coast at shallow inner shelf depths of about 2-30 m. Over half the macrofauna in the sandstone is inferred to have lived in our "shallow inner shelf sand community" in a moderately exposed location at similar depths of about 10-30 m. We conclude that these faunas represent the *in situ* biota and that the sandstone accumulated in this environment. The sandstone also contains substantial fossil material from our "rocky shore and coarse gravel community" that probably washed in from the surrounding coastline of the bay. Other identifiable elements in the sandstone macrofossil assemblage include members of our "nektonic fauna" that are inferred to have floated in from farther out to sea, and leaves and estuarine snails that must have washed in from nearby land.

Within the 12 m of sandstone there is no detectable change in the fossil fauna, except that it is less abundant in the upper parts. It presumably accumulated during a period of sinking with sediment accumulation rate keeping pace with the subsidence.

Other early Miocene Kawau Subgroup sequences on Kawau Island and elsewhere, indicate that the Fossil Point sequence documents just a short interval within a long period of major subsidence, in the order of 1-2 km, that formed the Waitemata Basin (Ricketts *et al.* 1989, Hayward 1993). The Fossil Point sequence records some of the earliest subsidence, when nearby land areas or islands had not yet subsided beneath the waves and their erosion provided the gravel and sand that accumulated in this ancient bay preserving the fossil assemblages within it. Once all local land areas had been submerged, this area became starved of sediment and there followed a long period with little or no sediment accumulation, until the



area had subsided to mid bathyal depths and sand-bearing turbidites from the northwest could flow across the basin floor to reach it (Ricketts *et al.* 1989, Hayward 1993).

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M.K. EAGLE and B.W. HAYWARD, Auckland Institute and Museum, Private Bag 92018, Auckland. G. CARTER, 1 Guardwell Tce., Mount Albert, Auckland.

APPENDIX 1. Systematic list of macrofauna from Fossil Point, Bostaquet Bay, Kawau Island, Hauraki Gulf. Taxonomy follows Beu *et al.* (1990) for Mollusca; Dawson (1990) for brachiopods; Foster (1978) and Buckeridge (1983) for barnacles; Squires (1958, 1962) for coelenterates; Feldmann & Keyes (1992) for decapod Crustacea; Chapman (1918) and Vickers-Rich *et al.* (1991) for chondrichthyans; Henderson (1975) for spatangoid echinoids; Fell (1954) for cidarid echinoids; Fleming (1971) and Hayward (1977) for Polychaeta; E. Fordyce (pers. comm.) for Cetacea; and Pole (1993a, 1993b), and E. Cameron and R. Gardner (pers. comm.) for vascular plants. Specimens are located in the Auckland Institute and Museum collection unless stated otherwise: GC = Glen Carter; ME = Michael Eagle. Species numbers are: A = abundant; C = common; U = uncommon.

BIVALVIA			
GLYCYMERIDIDAE	<i>Tucetona aucklandica</i> (Powell, 1938)	GC	C
PTERIIDAE	<i>Pteria oneroaensis</i> (Powell & Bartrum, 1929)		U
MYTILIDAE	<i>Perna tetleyi</i> (Powell & Bartrum, 1929)		U
PECTINIDAE	<i>Mesopeplum burnetti</i> (Zittel, 1864)	ME	C
	<i>Mesopeplum costatostriatum</i> (Marshall, 1918)	ME	C
	<i>Lentipecten hochstetteri</i> (Zittel, 1864)		U
	<i>Lentipecten</i> n. sp. aff. <i>hochstetteri</i> (Zittel, 1864)	ME	U
	<i>Chlamys fischeri</i> (Zittel, 1864)		C
ANOMIIDAE	<i>Anomia trigonopsis</i> Hutton, 1877	ME	C
LIMIDAE	<i>Lima colorata</i> Hutton, 1873		C
GRYPHAEIDAE	<i>Crenostrea gittosina</i> (Powell & Bartrum, 1929)		A
LUCINIDAE	<i>Divaricella (Divalucina) huttoniana</i> (Vanatta, 1901)		C
	<i>Miltha neozelanica</i> Marshall & Murdoch, 1921	GC	U
	<i>Megacardita squadronensis</i> (Powell, 1938)		U
CARDITIDAE	<i>Eucrassatella ampla</i> (Zittel, 1864)		A
CRASSATELLIDAE	<i>Hedecardium (Titanocardium) greyi</i> (Hutton, 1873)		U
CARDIIDAE	" <i>Tellina</i> " <i>hesterna</i> (Powell & Bartrum, 1929)		C
TELLINIDAE	<i>Bartrumia oneroaensis</i> (Powell & Bartrum, 1929)		U
VENERIDAE	<i>Dosinia (Raina) bensoni</i> Marwick, 1927		A
TEREDINIDAE	<i>Bankia turneri</i> Powell & Bartrum, 1929		A
PERIPLOMATIDAE	<i>Offadesma angasi</i> (Crosse & Fischer, 1864)	ME	U
GASTROPODA			
NACELLIDAE	<i>Cellana thomsoni</i> Powell & Bartrum, 1929	ME	U
HALIOTIDAE	<i>Haliotis (Sulculus) flemingi</i> Powell, 1938		U
	<i>Haliotis (Notohaliotis) waitemataensis</i> Powell, 1938		U
	<i>Astraea bicarinata</i> Suter, 1917		U
TURBINIDAE	<i>Cookia kawauensis</i> Powell, 1938		U
	<i>Sarmaturbo superbus</i> (Zittel, 1864)		A
	<i>Pyrasmus consobrinus</i> Powell & Bartrum, 1929	ME	U
POTAMIDIDAE	<i>Maoricolpus waitemataensis</i> (Powell & Bartrum, 1929)		A
TURRITELLIDAE	<i>Tropicolpus tetleyi</i> (Powell & Bartrum, 1929)		U
	<i>Tropicolpus (Amplicolpus) gittosinus</i> (Powell & Bartrum, 1929)		U
	<i>Borsonia</i> n.sp.		U
TURRIDAE	<i>Struthiolaria lawsi</i> Powell & Bartrum, 1929		U
STRUTHIOLARIDAE	<i>Zegalerus perampla</i> (Powell & Bartrum, 1929)		U
CALYPTRAEIDAE			

NATICIDAE	<i>Magnatica (Spelaenacca) waitemataensis</i> (Powell, 1938)	GC	U
EPITONIIDAE	<i>Cirsotrema firmatum</i> Laws, 1939		U
BUCCINIDAE	<i>Paracomina lignaria</i> (Powell & Bartrum, 1929)		U
HARPIDAE	<i>Morum (Oniscidia) harpaforme</i> Powell & Bartrum, 1929		U
CONIDAE	<i>Conilithes wollastoni</i> Maxwell, 1978	ME	U
	<i>Conus thorae</i> Finlay, 1926	ME	U
SCAPHOPODA			
DENTALIIDAE	<i>Antalis pareoraensis</i> (Pilsbry & Sharp, 1897)		U
	<i>Dentalium mantelli</i> Zittel, 1864		U
	<i>Fissidentalium</i> n.sp.		U
CEPHALOPODA			
ATURIIDAE	<i>Aturia cubaensis</i> (Lea, 1841)		U
BRYOZOA			
	gen. & sp. indet.		A
BRACHIOPODA			
CANCELLOTHYRIDIDAE	<i>Terebratulina suessi</i> (Hutton, 1873)		C
DALLINIDAE	<i>Magasella neozelandica</i> (von Ihering, 1903)		A
HEMITHYRIDIDAE	<i>Notosaria antipoda</i> (Thomson, 1918)		A
POLYCHAETA			
SERPULIDAE	<i>Protula</i> cf. <i>turbularia</i> (Montagu, 1803)	GC	C
	gen. & sp. indet.		C
ECHINOIDEA			
CIDARIDAE	<i>Phyllacanthus titan</i> Fell, 1954		C
	<i>Goniocidaris pusilla</i> Fell, 1954		U
	<i>Histocidaris mackayi</i> Fell, 1954	ME	U
ARBACIOIDA	<i>Arbia</i> n.sp.	ME	C
STOMECHINIDAE	<i>Phymechinus</i> n.sp.	ME	U
PEDINOIDA	<i>Steroepeдина</i> n.sp.	ME	U
TOXOPNEUSTIDAE	<i>Schizechinus</i> n.sp.	ME	U
SPATANGOIDEA	<i>Opissaster rotundatus</i> (Zittel, 1864)		U
ECHINONEIDAE	<i>Echinoneus</i> n.sp.	ME	U
CIRRIPPEDIA			
ARCHAEOBALANIDAE	<i>Notobalanus vestitus</i> (Darwin, 1854)		C
	<i>Armatobalanus motuketeketeensis</i> Buckeridge, 1983	GC	U
	<i>Tasmanobalanus grantmackiei</i> Buckeridge, 1983	ME	U
DECAPODA			
OCYPODIDAE	<i>Hemiplax</i> sp.	ME	U
	gen. & sp. indet. (chela)	GC	U
COELENTERATA			
PORITIDAE	<i>Alveopora polycanthus</i> Reuss, 1867		C

FAVIIDAE	<i>Leptastrea cf. transversa</i> Klunzinger, 1879		C
OCULINIDAE	<i>Oculina virgosa</i> Squires, 1958		U
CHONDRICHTHYES			
ODONTASPIDIDAE	<i>Odontaspis elegans</i> Agassiz, 1843	ME	U
CARCHARIIDAE	<i>Carcharias taurus</i> Rafinesque, 1810	ME	U
LAMNIDAE	<i>Isurus desori</i> (Agassiz, 1843)	ME	U
TELEOSTEI			
SCARIDAE	gen. & sp. indet. (scale)	GC	U
	<i>Sargus laticonus</i> Davis, 1888	ME	U
CETACEA			
	gen. & sp. indet. (tooth)		U
	gen. & sp. indet. (rib)	GC	U
REPTILIA			
	gen. & sp. indet. (?turtle bone)		U
ICHTHOFOSSILS			
	<i>Nereites</i> sp. indet.		C
	<i>Skolithos</i> sp. indet.		C
	<i>Cruziana</i> sp. indet.		C
ALGAE			
RHODOPHYCEAE	<i>Rhodolith</i> sp. indet.		A
TERRESTRIAL FLORA			
LAURACEAE	<i>Laurophyllum longfordiensis</i> (Holden, 1982)	GC	U
FAGACEAE	<i>Nothofagus</i> sp.	GC	U
MYRTACEAE	? <i>Metrosideros</i> sp.		U

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APPENDIX 2. List of foraminifera obtained from Fossil Point, Kawau Island. Numbers are abundances (%) in each sample. Taxonomy follows Hornibrook *et al.* (1989) and Hayward & Buzas (1979).

	R09/f79	R09/f78
<i>Amphistegina aucklandica</i>	22	11
<i>Amphistegina</i> sp.	3	3
<i>Bolivina semitruncata</i>	1	
<i>Cibicides notocenicus</i>	6	
<i>Cibicides mediocris</i>	12	14
<i>Cibicides vortex</i>	6	4
<i>Cibicides perforatus</i>	1	
<i>Cibicides temperatus</i>	5	12
<i>Cribrorotalia ornatissimum</i>	7	2
<i>Discorotalia tenuissima</i>	1	
<i>Elphidium gibsoni</i>	17	39
<i>Gaudryina convexa</i>	9	9
<i>Globocassidulina subglobosa</i>	1	
<i>Gyroidina zelandica</i>		1
<i>Notorotalia powelli</i>	4	1
<i>Melonis maorica</i>	1	1
<i>Quasibolivina finlayi</i>	2	1
<i>Semivulvulina capitata</i>	1	1
<i>Stilostomella pomuligera</i>	1	
Percent planktics	2	1

# A NEW GENUS AND TWO NEW SPECIES OF NORTHERN NEW ZEALAND LANDSNAILS (MOLLUSCA: PUNCTIDAE)

F.M. CLIMO AND J.F. GOULSTONE

*Abstract.* *Kokikora* n. gen. is established containing two new species. *Kokikora angulata* n. sp. is widely distributed mainly in the North Auckland Peninsula, and *Kokikora mimiwhangata* n. sp. has been found at only a few sites on the east coast of Northland. Both snails seem to prefer a coastal habitat.

During a survey of recent, and sub-fossil deposits on dunes at Mimiwhangata in Northland, New Zealand, Dr Fred Brook and J.F.G. discovered a small undescribed punctid with an apparently limited distribution and habitat preference. The snail was also found in a similar situation at Deep Water Cove and Whangaruru to the north. Also found in the area, both alive and in the sub-fossil deposits, was a similar but much larger species, widely distributed in the north, with sporadic occurrences further south. Though long known to local malacologists it has never been formally described. While clearly recognised as members of the family Punctidae neither of these species seems assignable to any known generic group so we have erected a new genus to accommodate them.

The taxon descriptions and distributions given in this paper are based on specimens held in the Auckland Museum (AK), the Museum of New Zealand (MNZ) and in one case the Auckland University Geology Department (AUG). For type material, the number of specimens is given in parentheses following the accession number. The following names of collectors which occur frequently in the distribution records are referred to by initials only: F. Brook, F.M. Climo, J.F. Goulstone, B.F. Hazelwood, P. Mayhill, R. Parrish, D.J. Roscoe. Map references are from the N.Z.M.S. 260 series and all dates refer to the 20th century.

## SYSTEMATICS

FAMILY: PUNCTIDAE Morse, 1864

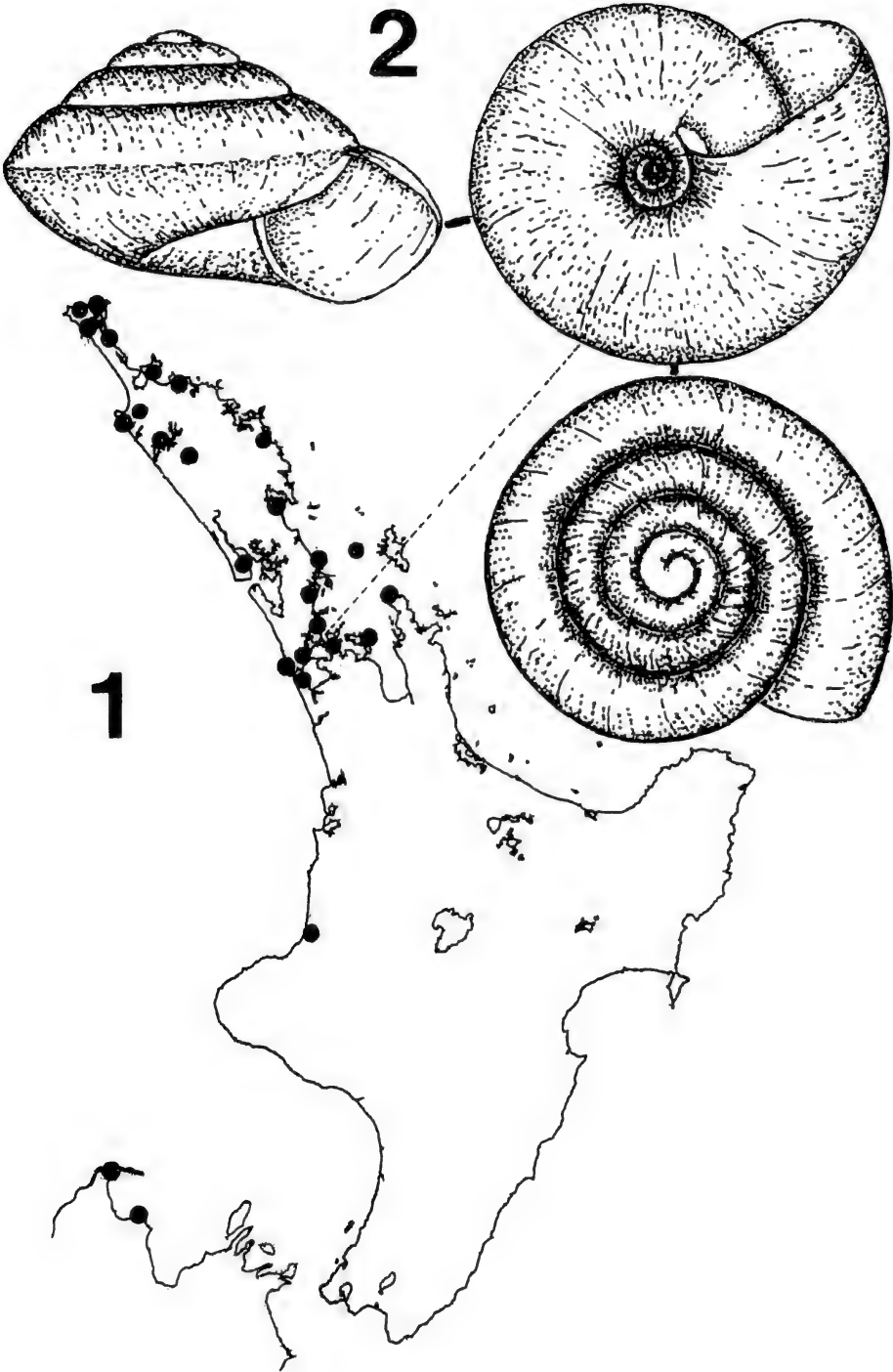
GENUS: *KOKIKORA* n. gen.

ETYMOLOGY: Derived from Maori, *koki* = bent; *kora* = fragment.

TYPE SPECIES: *Kokikora angulata* n. sp.

## GENERIC DESCRIPTION

Shells small (less than 3 mm), unicoloured, turbate or depressed turbate, with distinctly (though not sharply) angled bodywhorls. Protoconch mostly smooth or with faint spiral sculpture. Post-nuclear whorls either smooth or having some growth ridges. Umbilicus



Figs 1-2. *Kokikora angulata* n. sp. 1. Geographic distribution, abridged. 2. Waikowhai, 1.8 mm x 1.3 mm (holotype AK72415).



relatively wide up to a quarter of width of shell. Animal with light black markings and some yellow pigment on the visceral coil. Male genitalia with narrow external epiphallus about the same length as the penis which it enters sub-apically just below the penis retractor muscle. Terminal female genitalia with short vagina and narrow free oviduct. The entrance to the spermathecal duct as wide or wider than the oviduct and extending into a considerable pocket before reducing to a fine tube. (Based on both species in the genus).

***Kokikora angulata* n. sp. Figs 1-6**

Synonymy: '*Paralaoma*' n. sp. 38 Solem, Climo & Roscoe 1981:479. Ballance 1982:31. Punctid n.sp. 38 Goulstone, Mayhill & Parrish 1993:19. Goulstone 1983:45. Goulstone 1990:41. N. gen.1, n. sp.1 Climo 1993:27,35.

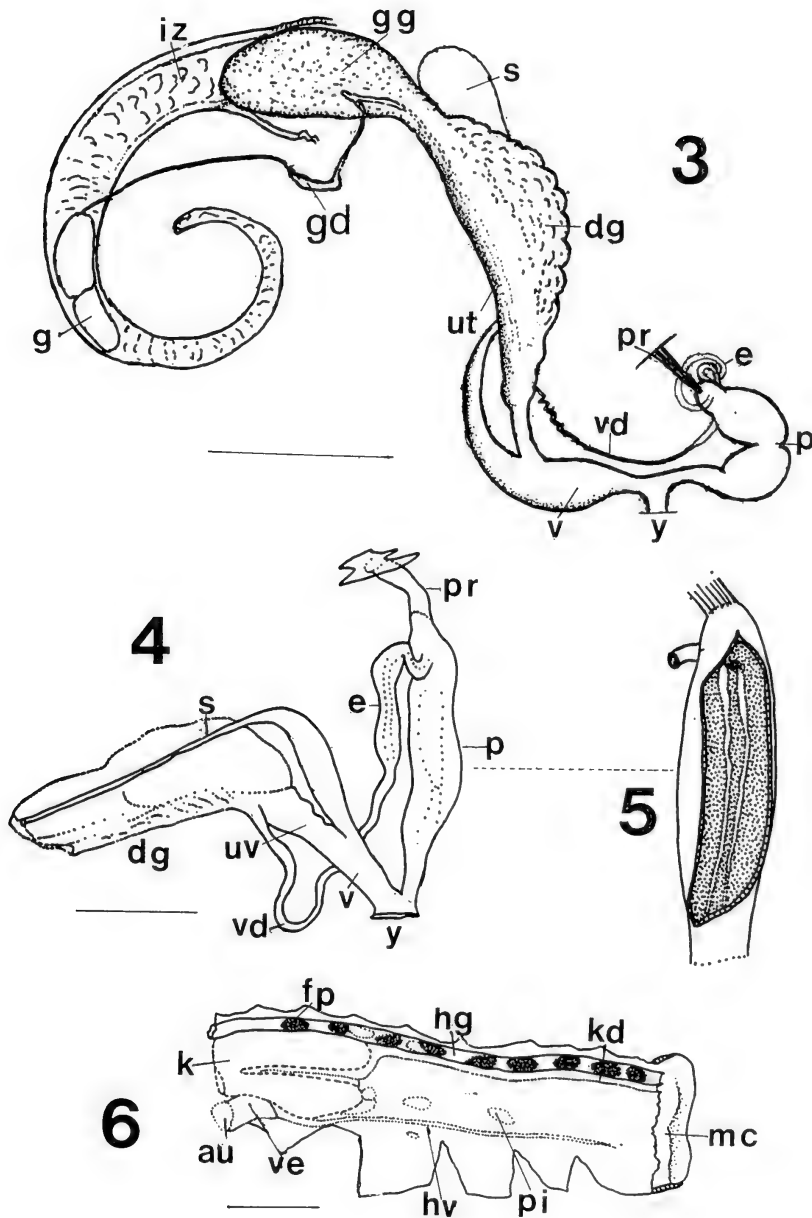
**DESCRIPTION**

Shell small (maximum diameter recorded 2.4 mm, but most adults nearer 1.8 mm), depressed turbinate, mainly transparent and faintly brown coloured when adult. Juveniles often white. No sculpture other than irregular growth lines and very faint microscopic spirals extending at same strength over whole shell. With the animal inside, mantle pigmentation as viewed through base of shell often gives effect of fine radial sculpture. Whorls, about four and a half on an adult shell, regularly expanding, slightly accelerating on the final whorl. Sutures slightly impressed and body whorl with a definite angle, though not sharp. Umbilicus moderately wide, between one quarter and one fifth of maximum diameter. Protoconch, of one and a quarter whorls flat and moderately large (one third to one quarter of maximum shell width).

Animal with black scratchy markings over the mantle roof and further patches on the albumen and digestive glands. Lines and blobs of yellow white pigment occur over most of the visceral coil. Male genitalia consist of a narrow epiphallus about the same length as the extended penis, which it enters just beneath the penis retractor muscle. With the animal retracted in the shell the penis has a sharp bend in the middle and the epiphallus has several coils. Female genitalia consist of a short vagina and narrow, short oviduct. The start of the spermathecal duct is wider than the oviduct and it maintains this width for twice the length of the oviduct before reducing to a very fine tube. The pear shaped spermathecal sac rests at the base of the albumen gland. The prostate gland is prominent, consisting of a clear jelly-like mass adjoining the uterus. The ovotestis, imbedded about half way along the digestive gland, consists of two oblong clumps almost joined together comprising finger like fused sections. These are connected to the talon, buried in the base of the albumen gland, by an extremely fine tube with a short swollen section near the gland. The kidney is bilobed with equal lobes. (Based on five dissections.)

**REMARKS**

This species possesses a plain shell which is, however, easily recognised by its angled body whorl and moderately wide umbilicus. *K. mimiwhangata* n. sp. (see below) is similar but the two species should be easily separated on size. Shells of *K. angulata* were prominent in the sub-fossil deposit at Mimiwhangata, where some specimens were 2.4 mm in greater shell diameter. Some shells found over an old midden alongside the Mangere Oxidation Ponds



Figs 3-6. *Kokikora angulata* n. sp. 3. Reproductive tract (Helena Bay specimen). 4-6. Nelson specimen. 4. Distal genitalia. 5. Detail of penis lumen. 6. Mantle. Abbreviations: au - auricle, dg - prostate, e - epiphallus, fp - faecal pellet, g - ovotestis, gd - hermaphroditic duct, gg - albumen gland, hg - hindgut, hv - principal pulmonary vein, iz - stomach, k - kidney, kd - ureter, mc - mantle collar, p - penis, pi - pigment spot, pr - penial retractor muscle, s - spermathecal shaft and its sac, ut - uterus, uv - post uterine oviduct, v - vagina, vd - vas deferens, ve - ventricle, y - genital atrium.

Scale lines = 0.5 mm.

(R11 659675, J.F.G.) were of a similar size. Mature individuals in extant populations are predominantly 1.8 mm in shell diameter.

The disjunct western distribution of *K. angulata* (Fig. 1) has a parallel with several plant species (Heads 1993): *Hebe gracillama* (Kirk, 1896), *H. townsonii* (Cheeseman, 1913), *H. speciosa* (A. Cunn., 1836).

**TYPE LOCALITY:** Waikowhai Reserve, Manukau Harbour, North Island, New Zealand, along coastal cliffs, R11 724646.

**HOLOTYPE:** Auckland Museum, AK72415. 1.8 mm x 1.3 mm, J.F.G. 19/10/91.

**PARATYPES:** All from type locality. AK72415 (6), J.F.G., 19/10/91. MNZ116462 (10), J.F.G. 19/10/91.

#### HABITAT

Coastal. It sometimes occurs away from the coast but in small numbers. In other elements of the New Zealand land snail fauna this coastal preference can be taken as calciphile but *K. angulata* has not been particularly associated with limestone in the available collections. At Mimiwhangata most of its coastal habitats have been destroyed and it is present only in the epiphytes of remnant trees, particularly pohutukawa (*Metrosideros excelsa*). The snail is not found on nikau (*Rhopalostylis sapida*). At Waikowhai, the type locality, *K. angulata* occurs along coastal cliffs on the ground under pohutukawa, karaka (*Corynocarpus laevigatus*), and kawakawa (*Macropiper excelsum*) but could not be found on the low foliage or on the trunks. Here the foliage was covered with *Tornatellides subperforata* (Suter) (Achatinellidae), while *Phrixgnathus moellendorffi* (Suter) (Punctidae) inhabited the pohutukawa trunks as far up as we could reach, so perhaps these particular niches have been filled. There were no epiphytes on the Waikowhai pohutukawas. It was interesting to find *K. angulata* in the Auckland Domain, obviously a leftover from a population in the original bush which, before extensive land reclamation, would have been on the shoreline.

#### DISTRIBUTION (Fig. 1)

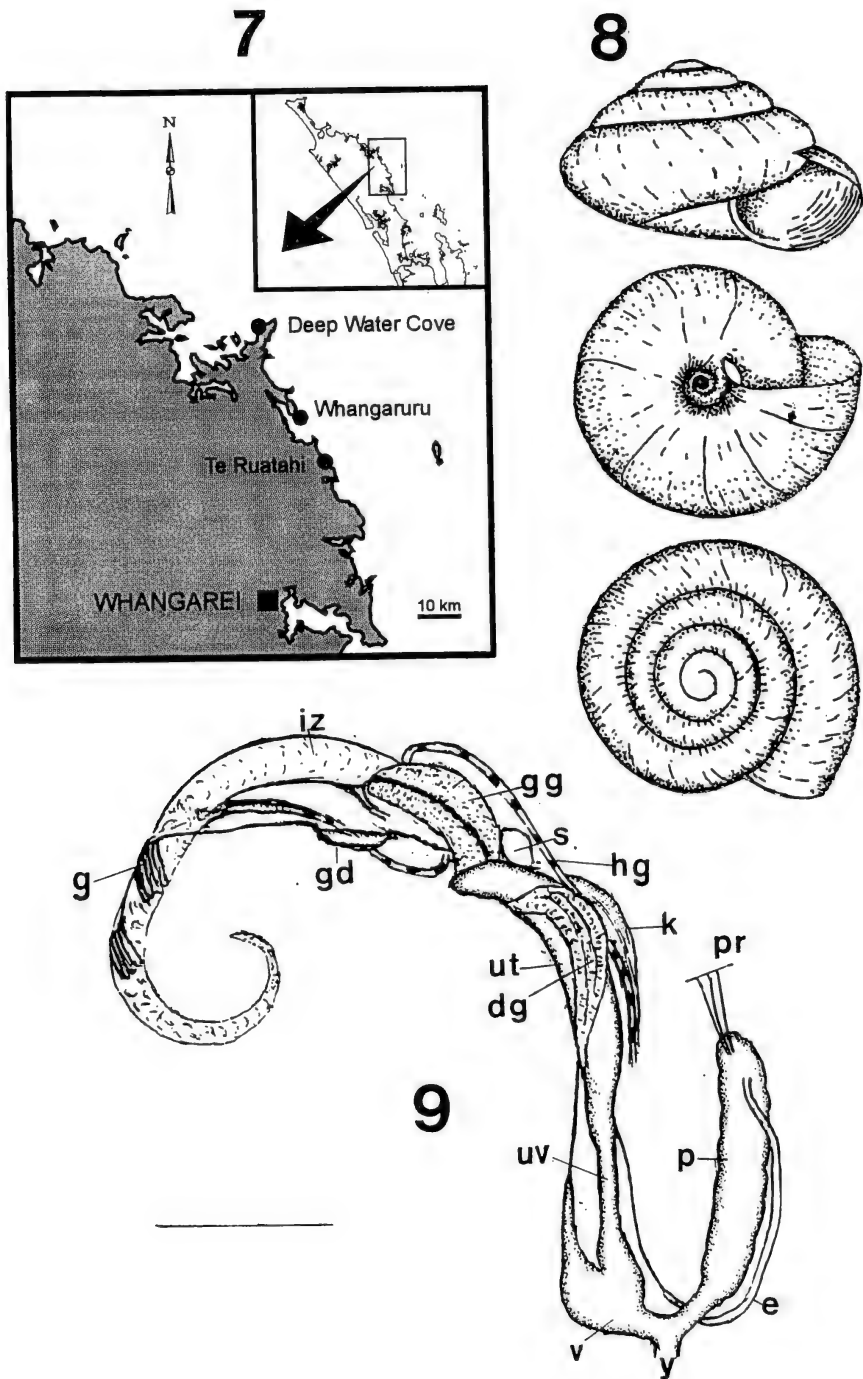
**N.W. Nelson:** Puponga Point, F.M.C. 3/1/67, MNZ 61562; Puponga Point manuka debris, F.M.C. 17/3/71, MNZ 38192; Takaka, Tata Island, B.F.H. 6/6/77, MNZ 87712. **North Taranaki:** Tongaporutu River mouth, coastal nikau, F.M.C. 8/3/77, MNZ 56593. **Manukau Peninsula:** Waipipi Scenic Reserve, Waiuku, F.M.C. & D.J.R. 11-12/2/81, MNZ 78546; head of Track Gully, F.M.C. 15/2/81, MNZ 77832. **Waitakere Ranges:** Titirangi, A.E. Brookes, undated, AK 82821; Te Henga, P.M. -/1/80, MNZ 99259; Houghtons Bush, Q11 387862, Q11 386869, J.F.G. -/11/82, AK 82829, P.M. -/5/78, MNZ 99245; Muriwai, Korekore Pa Hill, A.W.B. Powell 1925, AK 82822; Muriwai, Maori Pa Hill, collector and date unknown, AK 82830; Muriwai, J.F.G. 1981, MNZ 70135. **Auckland:** Motutapu Is. midden, R. Nichols 1982-3, MNZ 80033; Motutapu under Rangitoto ash, B. McFadgen 13/2/74, MNZ 47340; Rangitoto Is. Site 3, B.F.H. 20/11/77, MNZ 68599; Waikowhai, N. Gardner 20/3/80, MNZ 68022. Mangere Oxidation Ponds, sub-fossil, R11 659675, J.F.G. 28/2/92, AK 82831. St. Heliers, Dingle Dell R11 759810, J.F.G. 14/9/86, AK 82832. Auckland Domain, R11 688812, J.F.G. 27/12/86, AK 82833. Hobsonville R.N.Z.A.F. base, P. Sudlow -/12/80, MNZ 70756.

**Coromandel Peninsula**, Port Jackson, fossil, S09 226211, J.F.G. -/1/78, MNZ57802, MNZ 57846. **Little Barrier Island**, under kanuka, J.S. Edwards, -/1/53, AK 82826. **Mahurangi**, Ngarewa Drive, R10 652192, B.F.H. 31/1/87, MNZ97680. **Warkworth**, Sandspit, R09 623320, D.J.R. 25/12/78, MNZ104369. Whangateau Beach, B.F.H. 31/1/87, MNZ99466. Poutu Peninsula, Tapu Bush, P09 072421, R.P. 11/2/88, MNZ96675, P.M. -/10/86, MNZ97744. **Whangarei**: Coronation Reserve, P.M. -/2/80, MNZ68765; Skull Creek, limestone, Q07 348972, R.P. -/7/88, MNZ99454. Mimiwhangata, sub-fossil deposit, Q06 407371, F.B. 1993, AK 82824, P.R. Millener 22/2/78, Auckland University Geology Dept. Q06 404370, F.B. & J.F.G. 7/12/93, AK 82827. Helena Bay, Q06 356395, F.B. 15/5/94. **Maunganui Bluff**: D.J.R. 6/10/76, MNZ61950, B.F.H., MNZ52487; Moir Rd., P.M. -/2/80, MNZ63301. Opononi, N.E. of, Motutoa midden, O06 492349, C. Fredericksen 1989, MNZ97504. **Waima Forest**: Mountain Rd. O06 515345, J.F.G. -/5/90, AK 82838; Waitemarama, P.M. -/11/86, MNZ98254. Warrawarra Sth. Maungataniwha, O05 371436, P.M. -/1/90, MNZ101636. **Cavalli Islands**, astelia clumps on pohutukawas, P04 971890, R.P. 27/8/88, MNZ99418. Whangaroa Motor Camp, head of small valley, P04 792814, D.J.R. 27/12/78, MNZ104360. Te Puna Bush, P05 063669, P.M. -/1/90, MNZ101576. Rawhiti roadside, Q05 251618, P.M. /8/87, MNZ98812. Ahipira-Hunahuna Catchment, P.M. -/11/87, MNZ98789. **Herekino**: North, Larmers Rd. P.M. -/10/78, MNZ62491; Gorge, N05 283657, J.F.G. -/1/69, AK 82834, between Ahipara & Manukau, B.F.H. 4/1/76, MNZ48684. Mangonui, Oruru Valley, manuka scrub, R. Wallace 1986, MNZ87652. **Doubtless Bay**, Tokerau dunes, A. Richardson, AK 82837. **Mangamuka Gorge**: Bridge, B.F.H. 1/1/76, MNZ 48663, P.M. -/10/78. **Hohoura**: Mt. Camel, B.F.H. 4/1/76, MNZ61561, MNZ70085, N03 258088, R.P. & K. Walker 26/3/88, MNZ96554, W. base, P.R. Jamieson 12/1/75, MNZ88455. Puruhi Island, Motu, N03 252162, R.P. 4/8/88, MNZ99433. **Te Paki**: Spirits Bay, N02 922497 J.F.G. 11/5/91, AK 82835; Waterfall Ck., B.F.H. 3/1/76, MNZ70044, MNZ47953; Tapotupotu Res., A.W.B. Powell, 9/3/67, AK 82828; Whareana *Placostylus* colony, P.M. -/5/82, MNZ79014; Aupouria Archaeological Study N3&4/168-b-1 "A", R. Wallace 1980, MNZ74054, "B", MNZ 74015; Spirits Bay - Te Hapua junction, N02 966449, P. Anderson *et al.* 4/3/85, MNZ81788; Ngaiwitararoa Pa, N02 977450, P. Anderson *et al.* 4/3/85, MNZ77125; Aupouria State Forest, J. Coster 1981, MNZ70432; North Cape, N02 966449, G. Carlin -/7/84, MNZ79649, Maori land N1/46-44, loc. 1 & 2, B.F.H. -/10/76, MNZ54249; Northern Block, N02 093474, R.P. 16/3/88, MNZ96622, N02 087464, C. Ogle 5/3/85, MNZ76981; Waitanoni Stream, Kapowairua catchment, N02 001525, C. Ogle *et al.* -/11/86; Ponaki Stream, site G(7) 20 m, N02 086463, C. Ogle *et al.* -/11/86, MNZ87832; Unuwahao Pa site, N02 009518, C. Ogle *et al.* -/11/86, MNZ87919.

### *Kokikora mimiwhangata* n. sp. Figs 7-9

#### DESCRIPTION

Shell partly transparent, small (1.4 mm), turbinate. Adults with four and a quarter whorls. Colour greenish brown hardly changing from juvenile through to adult. Sutures moderately impressed and simple. In mature specimens the body whorl can drop producing a stepped effect between the last two whorls. Final whorl very lightly angled, hardly apparent in adult, more noticeable in juvenile. Protoconch relatively large, flattish and smooth, about one and a quarter whorls (one third to one quarter of maximum shell diameter). Post-nuclear sculpture consisting of only faint growth ridges. Umbilicus moderately open, about one quarter to one fifth the shell diameter.



Figs 7-9. *Kokikora mimiwhangata* n. sp. 7. Geographic distribution. 8. Mimiwhangata, Te Ruatahi, 1.4 mm x 0.9 mm (holotype AK72413). 9. Details of anatomy. Abbreviations as for Figs 3-6. Scale line = 0.5 mm.

Animal with little coloration in the mantle linings except for an occasional blob of yellow pigment. One specimen had a strong black line across the albumen gland. Male genitalia comprising comparatively long straight penis (1 mm) and equally long, narrow external epiphallus. When animal withdraws in shell the penis lies beside the narrow oviduct and uterus, behind the vagina. The vagina is short but wide, wider entering the spermathecal duct than the oviduct. The prostate is a delicate flat latticework organ curling around the top section of the uterus. The hindgut leaves the digestive gland about halfway along on the inside and loops round the back of the albumen gland before passing the kidney and exiting through the mantle collar. The kidney is bilobed, pointed where the ureter exits it. The ovotestis consists of two clumps of separate finger-like organs imbedded sub apically in the digestive gland. These are connected by a very fine tube with a considerable swelling where it nears the albumen gland then a reduction to a fine tube again to enter the talon in the base of the gland. (Based on two dissections.)

## REMARKS

This species has a restricted known range and is like a miniature form of *K. angulata*. Though it occurs in reasonable numbers at Mimiwhangata, Deep Water Cove and Whangaruru it was not seen in the sub-fossil deposits. *K. mimiwhangata* can easily be separated from *K. angulata* on size alone, as a specimen of the latter of 1.4 mm has only 2-3 whorls as opposed to the former's four. *K. mimiwhangata* has regularly increasing whorls whereas the final whorl of *K. angulata* is somewhat expanded. *K. mimiwhangata*, though it has no ribbing, could also be confused with *Paralaoma lateumbilicata* (Suter), for it is similar in size and general appearance.

TYPE LOCALITY: Mimiwhangata, behind Te Ruatahi Beach, Northland, North Island, New Zealand, Q06 399373.

HOLOTYPE: Auckland Museum, AK 72413, 1.4 mm x 0.9 mm, F.B. & J.F.G. 7/12/93.

PARATYPES: AK72414 (12), Q06 402375, F.B. & J.F.G. 28/12/93. MNZ116461 (6), Q06 399373, F.B. & J.F.G. 7/12/93.

## HABITAT

We found this snail alive in fallen nikau fronds in remnant bush behind Te Ruatahi, Mimiwhangata, and similarly behind a small bay at Whangaruru and at Deep Water Cove. At Whangaruru one live specimen was found in a very low epiphyte but although we sampled many epiphytes in a range of trees it was never found elsewhere. Dead specimens were found in several lots of litter under taraire (*Beilschmiedia tarairi*) at Mimiwhangata but there were plenty of nikau nearby.

## DISTRIBUTION (Fig. 7)

Deep Water Cove, Waitui Stream, Q05 299664, F.B. & J.F.G. 8/12/93, AK82839, MNZ116463; Whangaruru, north headland, Q05 343465, F.B. 24/6/94, AK83610.

## DISCUSSION

The coast between Cape Brett and Tauranga Kowau Point, at the southern end of the Mimiwhangata Coastal Park, has a snail fauna distinct from that of the rest of Northland. While *K. mimiwhangata* populations may have been overlooked, due to the small size and drabness of the shells, current evidence suggests the species is endemic and restricted to this faunal zone.

The coastal forest at Mimiwhangata, the type locality of *K. mimiwhangata*, has been largely destroyed for pastoral farming but the recent acquisition by the Department of Conservation of a large area for development as a Coastal Farm Park has meant that remaining areas of bush are being fenced and protected from stock. In particular the management of the fenced area of bush in the valley behind the Te Ruatahi Beach at the south end of the park will be critical for the survival of *K. mimiwhangata* in this location. An area of bush in a gully immediately to the north of this fenced area, opposite Komakoraia Island, though it was much damaged by stock and is probably thought to be not worth saving, nevertheless still retains a population of *K. mimiwhangata*. This population will be lost if present conditions are allowed to continue. However, 20 km north the reserve at Whangaruru North Head, containing as it does an important *Placostylus* colony, is quite secure, well managed and should ensure the survival of *K. mimiwhangata* at this site, though our sampling found it rather scarce. Further north at Deep Water Cove it was found in a small remnant of original bush surrounded by much that was regenerating. Though this was a reserve which should have a high conservation status, it appeared neglected and goats were a problem. *K. angulata* on the other hand is widespread, fairly hardy, lives in a variety of habitats, and on present evidence is not in danger.

*Acknowledgements.* Dr Fred Brook (Department of Conservation, Whangarei) collected some of the type material and offered much support in the field. Dr Bruce Hayward checked the manuscript and encouraged this study. Dr Hugh Grenfell assisted with maps. Gary Barker made constructive comments as a referee of this paper. Bruce Hazelwood also gave us useful advice.

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F.M. CLIMO, Museum of New Zealand, P.O. Box 467, Wellington. J.F. GOULSTONE, 89 Hall Avenue, Mangere, Auckland.

*Date of publication*

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## *EMOIA ADSPERSA* (LACERTILIA: SCINCIDAE) - CONFIRMED IN TONGA

B.J. GILL, D.R. RINKE AND G.R. ZUG

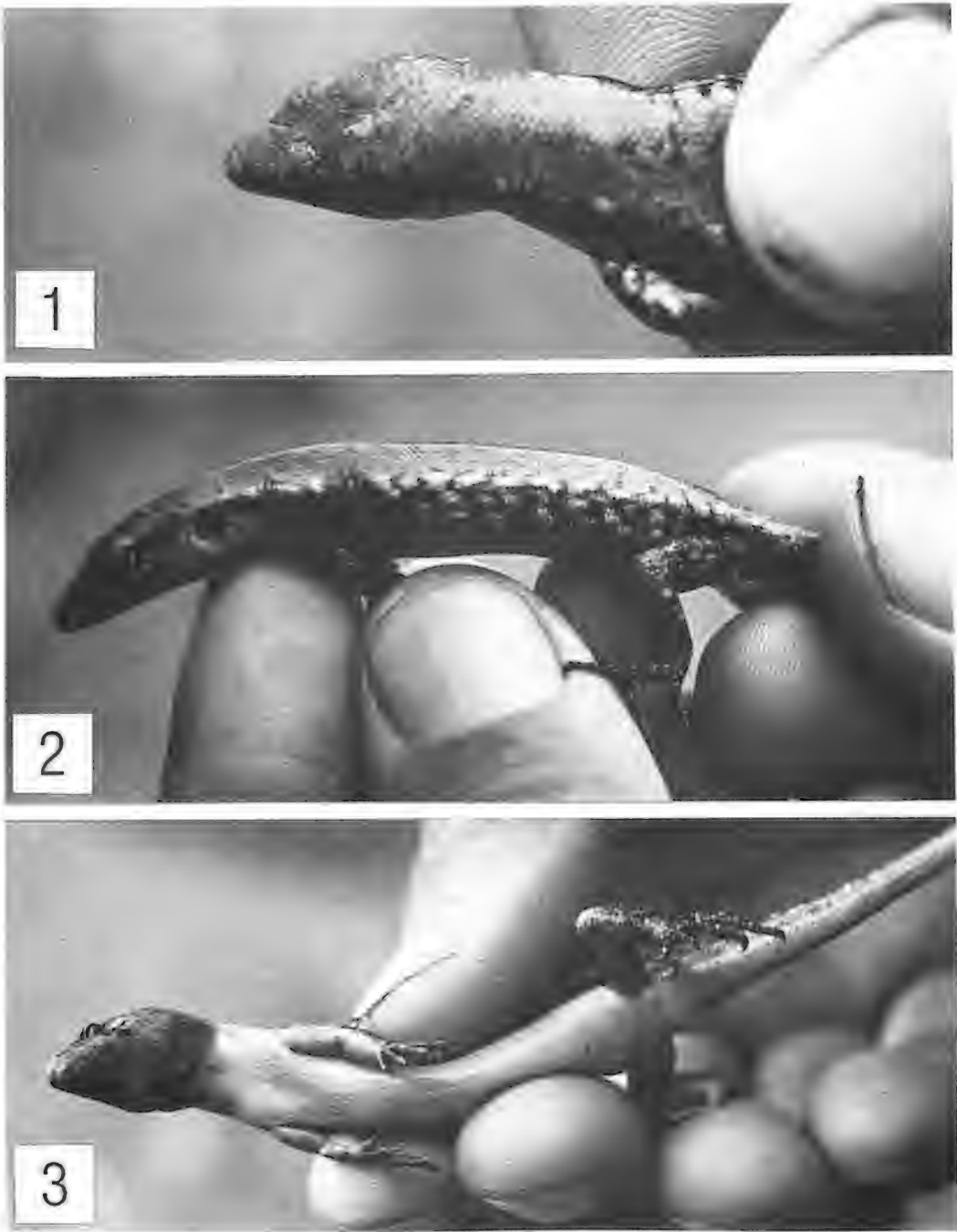
On 6 March 1994, one of us (DRR) caught an unusual skink near the road between the villages of Sapa'ata and Fata'ulua on the island of Niuafo'ou, northern Tonga. The road passes through mixed vegetation comprising coconut plantations (*Cocos nucifera*) and low secondary bush interspersed with large mango trees (*Mangifera indica*). The skink was resting in the sun on an exposed log. DRR saw similar skinks during many months of field work on Niuafo'ou, but at first took them to be juveniles of the moderately common Pacific Black Skink (*Emoia nigra*). He later suspected a different species was involved, and was able to catch a specimen. It was taken alive to the Brehm Fund Bird Park on Tongatapu, but escaped after three weeks.

Photographs (Figs 1-3; originals in colour) show that the skink had a golden brown dorsal surface and a black lateral band, all heavily patterned with light and dark blotches. The overall appearance is of a coarsely speckled lizard without longitudinal stripes. The ventral surfaces were grey with a pale yellow suffusion between the thoracic region and the vent. From the size of the human thumb-nail in Fig. 2 we estimate that the lizard had a snout-vent length of 71 mm. The pictures also show that it had a distinct interparietal head-shield and very small body scales. We can count at least 50 mid-body scale rows. These features all agree with the description of *Emoia adpersa* (Steindacher, 1870) which has 50-60 mid-body scale rows and a maximum snout-vent length of 85 mm (Brown 1991).

*E. adpersa* was not recorded in the Tongan herpetofauna by Gill & Rinke (1990), but was listed from northern Tonga by Zug (1991, table F) on the basis of a specimen in the National Museum of Natural History, Washington D.C. (USNM 82863). This specimen was collected from "Niaufou" (*sic*) on 1 September 1930 by H.C. Kellers during the U.S. Naval Eclipse Expedition. It is a juvenile of 33.2 mm snout-vent length and 47 mm tail length.

The sightings of *E. adpersa* reported here confirm that a population persists on Niuafo'ou. Schwaner & Brown (1984) reported *E. adpersa* from Funafuti (Tuvalu), Swains and Nukunonu Islands (Tokelau group), Pukapuka (Danger group), Savai'i and 'Upolu (Western Samoa) and Futuna (Wallis and Futuna group, unconfirmed). It is rarely encountered and there are few voucher specimens. The presence of *E. adpersa* on the northern Tongan outlier of Niuafo'ou represents a southerly extension of its known range, but it remains distributed "west and north of the American Samoan archipelago" (Schwaner & Brown 1984).

DRR saw specimens of *E. adpersa* along roads, in other open disturbed habitats and in *Pandanus* groves near the coast. He never saw them in the crater area of Niuafo'ou, where native forest dominates.



Figs 1-3. Skink from Niuafo'ou presumed to be *Emoia adspersa*. 1. Dorsal. 2. Lateral. 3. Ventral. (Photos: D.R. Rinke.)

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B.J. GILL, Auckland Institute and Museum, Private Bag 92018, Auckland, New Zealand.  
D.R. RINKE, Vogelpark Walsrode, Am Rieselbach, 29664 Walsrode, Germany. G.R. ZUG,  
Department of Vertebrate Zoology, National Museum of Natural History, Washington DC,  
U.S.A. 20560.



# BENTHIC ECOLOGY OF WHANGAPE HARBOUR, NORTHLAND

BRUCE W. HAYWARD, WILMA BLOM, MARGARET MORLEY,  
A. BRETT STEPHENSON AND CHRIS J. HOLLIS

*Abstract.* Whangape is a small Y-shaped harbour which opens to the Tasman Sea on the west coast of Northland through a narrow, 4 m deep and 4 km long gorge. The biota of the harbour floor sediments has a low diversity and is more like that of a large estuary than a northern harbour. Pipi (*Paphies australis*) and cockles (*Austrovenus stutchburyi*) are the dominant benthic organisms. Live pipi are largely subtidal and occur in the cleaner, coarser sediments of the entrance channel (up to 50 per litre) and Rotokakahi arm. Live cockle are intertidal and subtidal and mostly occur in muddy sediment of Awaroa arm, the central basin and lower Rotokakahi arm. The most diverse fauna occurs in the central basin just inside the entrance channel. Medium sand in the centre of the basin is dominated by pipi with associated hermit crabs, whelks (*Cominella glandiformis* and *C. maculosa*), chitons (*Chiton glaucus*), limpets (*Notoacmea helmsi*) and anemones (*Anthopleura aureoradiata*). Fine sandy mud to the sides of the basin is dominated by nut shells (*Nucula hartvigiana*), wedge shells (*Tellina liliana*) and cockles, with associated bivalves (*Notirus reflexus*), saucer limpets (*Sigapatella novaezelandiae*) and polychaetes (*Glycera tessellata*, *Owenia fusiformis* and *Lumbrinereis aotearoeae*).

## PREVIOUS WORK

There have been several previous studies on the ecological distribution of the bottom-dwelling biota of harbours and estuaries around New Zealand. Studies in northern New Zealand have mainly dealt with the larger harbours - Manukau Harbour (Grange 1979, 1982; Henriques 1977) and Waitemata Harbour (Powell 1937) - although Grace (1966) and Brook *et al.* (1981) documented the subtidal fauna of the smaller Whangateau and Tutukaka Harbours on the east coast and Hayward & Hollis (1993) described the fauna of the small estuary at the mouth of Waimamaku estuary, 30 km south of Whangape on the west coast.

## LOCATION AND DESCRIPTION

Whangape Harbour (latitude 36° 20', longitude 173° 15') is located on the west coast of Northland, between Hokianga and Herekino harbours (Fig. 1). Whangape is a relatively small "Y-shaped" harbour formed by the confluence of the estuaries or arms of two rivers. The harbour can be divided into four parts: the entrance channel, a shallow central basin and the two estuaries.

### (a) Entrance channel

The narrow entrance channel to the harbour is a former river gorge, with its sides rising steeply on both sides to 250-300 m above sea level. The entrance channel is almost 4 km long,

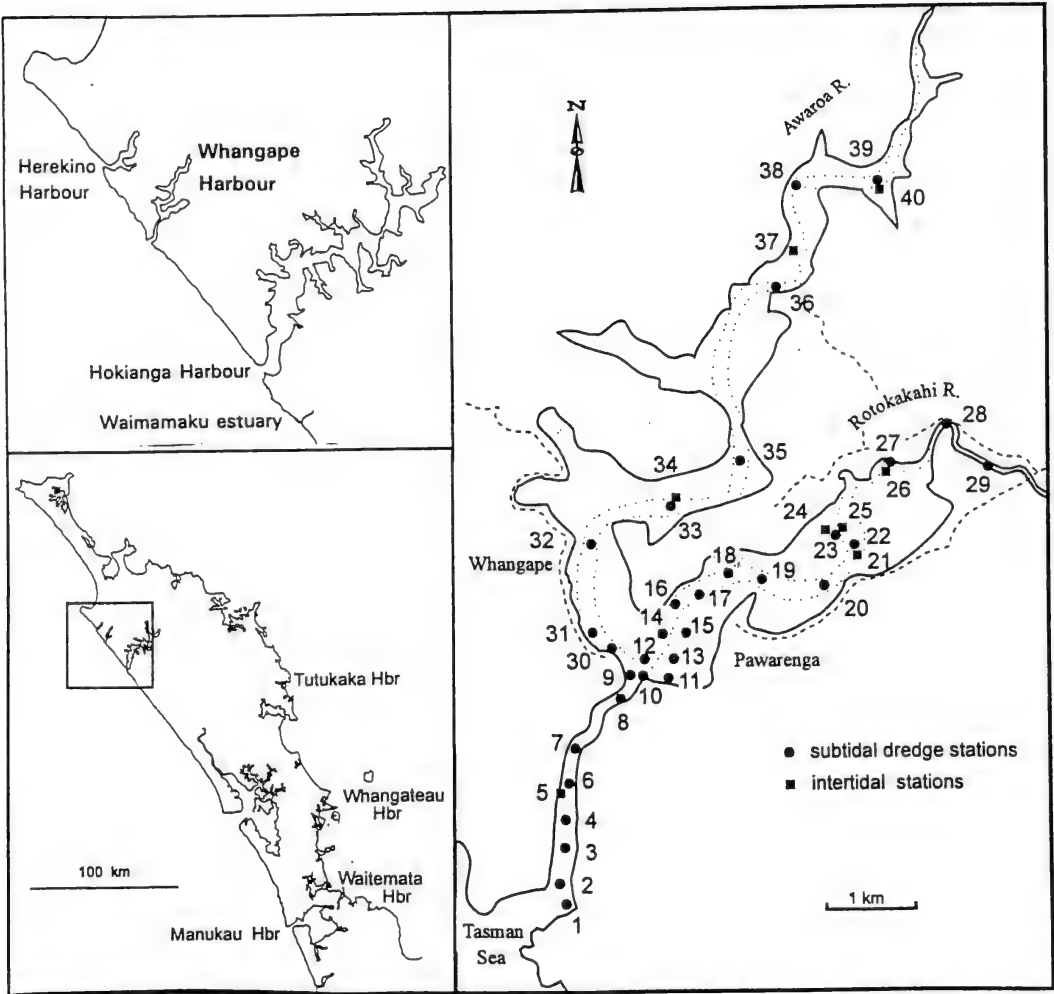


Fig. 1. Location of benthos sampling stations in Whangape Harbour, on the west coast of Northland.

straight for most of its length with a slight dogleg towards the mouth. It is 120 m wide at the landward end, slowly widening to 300 m at its mouth where it enters the Tasman Sea. Both sides of the entrance channel are lined with narrow gravel beaches or rocky coast. The channel has a near uniform depth of 3.5-4 m for most of its length, deepening only slightly to 5 m as it nears the central basin.

(b) Shallow central basin

The two estuaries meet in a broad, shallow central basin between Whangape and Pawarenga. At high tide this basin is approximately 1 by 2 km. At low tide, large areas are exposed as tidal sand and mud flats, cut by 2-5 m deep channels linking the estuaries with the narrow harbour entrance channel.

### (c) Two estuaries

The Awaroa River estuary is the northern and larger of the two, extending 11 km inland from its confluence with the smaller Rotokakahi River estuary, which extends 6 km inland. The subtidal channels of both estuaries are 1-3 m deep. The Awaroa estuary channel is 60-120 m across and is lined for most of its length by intertidal mangrove forest up to 500 m wide. The Rotokakahi estuary channel is 10-100 m wide and is lined by a combination of mangrove forest, salt marsh, and in its upper reaches, by eroding alluvial banks.

## FIELD METHODS

This survey was undertaken by BWH and CJH with the assistance of Michael Eagle, Clare Ward and Fred Brook on 11-12 April 1992. Samples were collected using a small, 4 litre capacity bucket dredge, hand-hauled from a 4 m aluminium dinghy powered by a 7 horse power outboard motor. The sediment was sampled to a depth of 50-100 mm. The sediment grain size was recorded and a 200 ml split was kept; the remainder was washed over a 2 mm sieve to remove mud and sand and then all live organisms were picked out, identified, counted and returned to the sea. Where the identification was uncertain, specimens were preserved and brought back to the museum for study. Voucher specimens of most taxa are held in the marine collections of the Auckland Institute and Museum.

## SEDIMENTS (Fig. 2)

The floor of Whangape Harbour has a wide range of sediment types.

### (a) Entrance channel

The outer 2 km of the narrow entrance channel is carpeted in well sorted, clean medium to coarse sand that has been swept in from the exposed seafloor outside the harbour mouth. The inner 2 km of the entrance channel is paved with shell gravel composed almost entirely of live and dead pipi shells. The strong tidal currents that sweep in and out of the harbour do not allow any sand or mud to settle on the floor of this 4 m deep channel.

### (b) Shallow central basin

Where the harbour broadens out, the floor is covered in fine sandy mud with a wedge of clean medium sand extending into the harbour basin immediately opposite the entrance channel.

### (c) Two estuaries

The extensive areas of intertidal mangrove forest and salt marsh along the margins of both arms have a silt or clay substrate. The subtidal (0.5-3 m deep) channels of the two arms have contrasting sediment types. The larger Awaroa River channel is floored with fine sandy mud which becomes pebbly mud near its head. The lower reaches of the smaller Rotokakahi River channel are floored with pebbly medium sand which grades upstream into fluvial pebbly coarse sand.

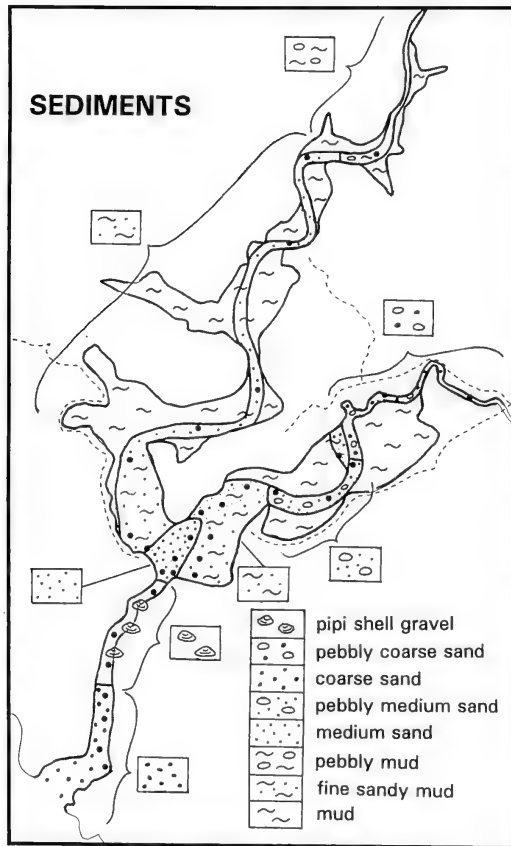


Fig. 2. Distribution of sediment types in Whangape Harbour. Sediment patterns in boxes summarise the geographic trends seen in the subtidal and intertidal sediments.

## ECOLOGIC DISTRIBUTION PATTERNS OF BENTHIC ORGANISMS

### (a) Entrance channel

The clean medium to coarse sand just inside the harbour mouth (stns. 1, 2) is home to numerous, albeit patchily distributed, sand dollars (*Fellaster zelandica*; Fig. 3) and very little else. The sand and shell gravel bottom of the remaining 3 km of the channel (stns. 4-8) is largely inhabited by a thriving population of pipi (*Paphies australis*; Fig. 3). Commonly associated are three species of the scavenging gastropod *Cominella* (*C. adspersa*, *C. glandiformis*, *C. maculosa*) and two species of hermit crab (*Paguristes pilosus* and *Pagurus novaezelandiae*; Fig. 4). Less common inhabitants of the pipi shell gravel of the entrance channel are several chitons, the gastropods *Xymene ambiguus* and *X. plebeius*, the Pacific oyster (*Crassostrea gigas*), the swimming crab (*Liocarcinus corrugatus*) and three polychaete worms (*Lepidonotus polychromus*, *Pherusa parmata* and *Streblosoma ?gracile*). The nut shell (*Nucula hartvigiana*) is common in the slightly deeper, sandier landward end of the channel approaching the central basin (Fig. 3).



### (b) Shallow central basin

The central basin contains a patchy mixture of benthic organisms which provide the most diverse fauna of the harbour. The wedge of medium sand that extends into the basin from the entrance channel is dominated by pipi (Fig. 3) with associated hermit crabs and whelks (*Cominella glandiformis* and *C. maculosa*). Also present on the pipi shells are occasional chitons (*Chiton glaucus*), limpets (*Notoacmea helmsi*) and anemones (*Anthopleura aureoradiata*). Other less common inhabitants are gastropods (*Diloma subrostrata* and *Xymene plebeius*), bivalves (*Felaniella zelandica*), crabs (*Cyclograpsus lavauxi*), clingfish (*Trachelochismus pinnulatus*) and polychaete worms (*Glycera americana*). The fine sandy mud substrate of the remainder of the central basin is dominated by combinations of three bivalves - nut shells, wedge shells (*Tellina liliana*) and cockles (*Austrovenus stutchburyi*; Fig. 3). Also present are rare specimens of the bivalve *Notirus refluxus*, saucer limpet (*Sigapatella novaezelandiae*) and polychaete worms (*Glycera tessellata*, *Owenia fusiformis* and *Lumbrineris aotearoae*).

### (c) Two estuaries

The intertidal mud of the mangrove forests and salt marsh that border both estuaries is largely inhabited by the mud crab (*Helice crassa*) and the mud snail (*Amphibola crenata*). The fine sandy mud of the subtidal channel of Awaroa estuary is dominated by rich populations of cockles (Fig. 3). Also present in the lower reaches are occasional specimens of the bivalves *Macra ovata* and nut shell, the crabs *Cyclograpsus lavauxi* and *Liocarcinus corrugatus* and shrimp *Pontophilus chiltoni*. The pebbly sand of the subtidal channel of Rotokakahi estuary is dominated by rich pipi populations. The only other live organisms recorded in these sediments are small numbers of cockles, which are restricted to the lower reaches.

## DISTRIBUTION PATTERNS OF INDIVIDUAL SPECIES

The dominant mollusc species in the harbour all appear to have independent distribution patterns that overlap in part.

### Pipi, *Paphies australis* (Fig. 3)

Live pipi are largely subtidal in Whangape Harbour and confined to the cleaner, coarser sediments of the entrance channel and Rotokakahi estuary channel. The species tolerates a wide range of salinity, from near normal in the entrance channel to highly brackish near the head of the estuary. At the time of the survey most of the pipi sampled were small. Those in Rotokakahi estuary were mostly 6-15 mm long, whereas those in the entrance channel were mostly 15-35 mm long. Two peaks of abundance were identified: one where the entrance channel meets the central basin, where pipi reached densities of up to 50 per litre; the second in the mid reaches of the estuary channel with a similar density.

### Cockle, *Austrovenus stutchburyi* (Fig. 3)

Live cockles are both intertidal and subtidal and mostly confined to finer, muddy sediments of Awaroa estuary, the central basin and lower Rotokakahi estuary. Cockles at low densities co-occur with pipi in the lower reaches of Rotokakahi estuary. Cockles appear to

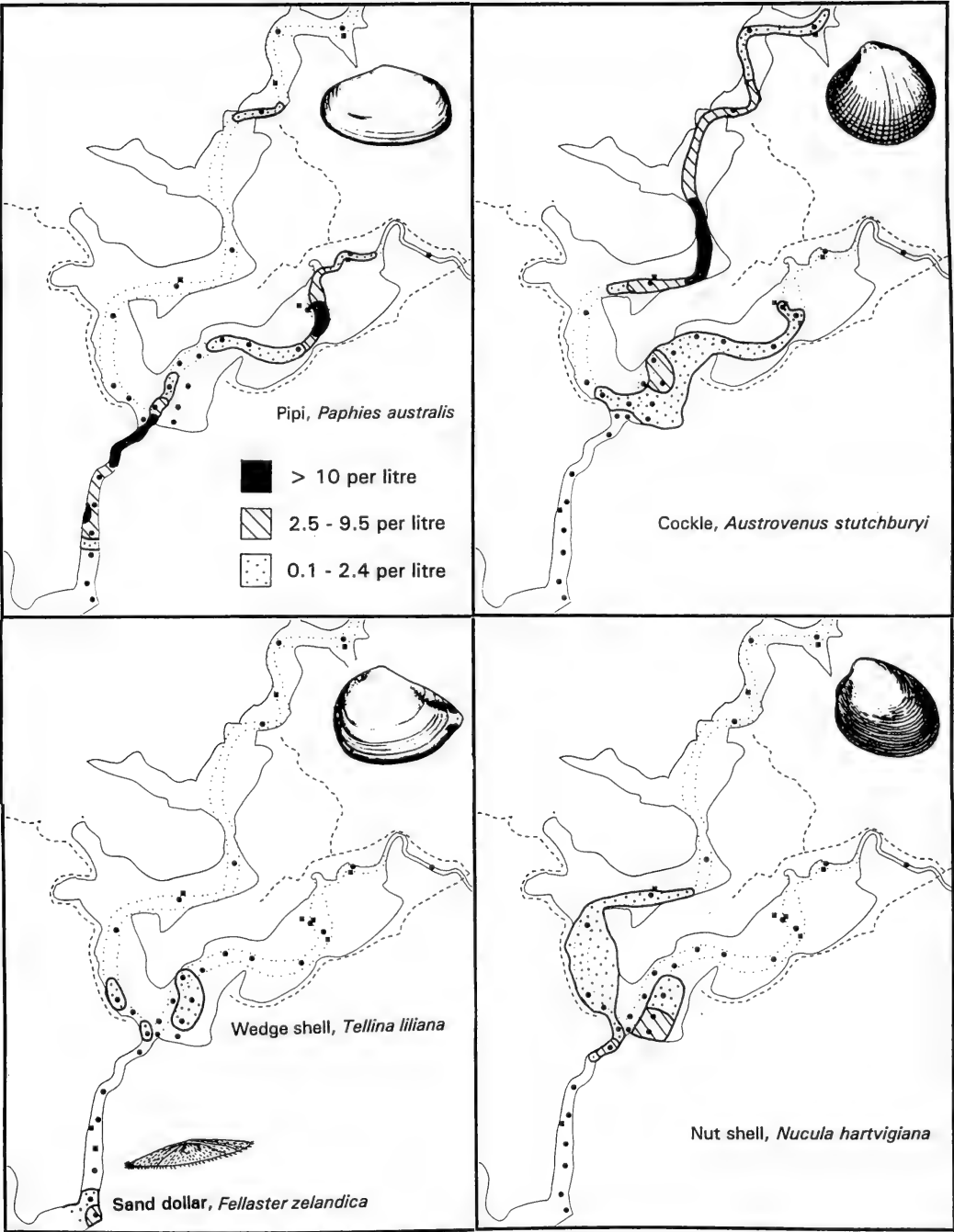


Fig. 3. Contoured abundance and distribution maps of the common molluscs and echinoderms in Whangape Harbour.

tolerate a similar wide range of salinity to pipi. Two peaks of abundance were identified: the greater density (10 per litre) is in the middle reaches of Awaroa estuary; the second peak (3 per litre) is in the low tidal fine sandy mud of the central basin.

Wedge shell, *Tellina liliana* (Fig. 3)

Live wedge shells live at low densities both intertidally and subtidally in fine sandy mud in the central basin. None were found up either estuary nor in the entrance channel. They overlap with the seaward part of the range of cockles.

Nut shell, *Nucula hartvigiana* (Fig. 3)

Live nut shells live intertidally and subtidally in both muddy and coarse sand substrates in and close to the central basin. The greatest abundance is 5 per litre in low tidal sandy mud (stn. 11). Nut shell distribution is similar to wedge shell, except that it extends seaward into coarse sediment in the entrance channel.

Whelks, *Cominella* spp. (Fig. 4)

The three species of whelks in Whangape Harbour have overlapping ranges and occur in the subtidal pipi gravel and sand of the entrance channel and central basin. *C. glandiformis* is the most abundant and has the widest recorded distribution.

Hermit crabs, *Pagurus* and *Paguristes* (Fig. 4)

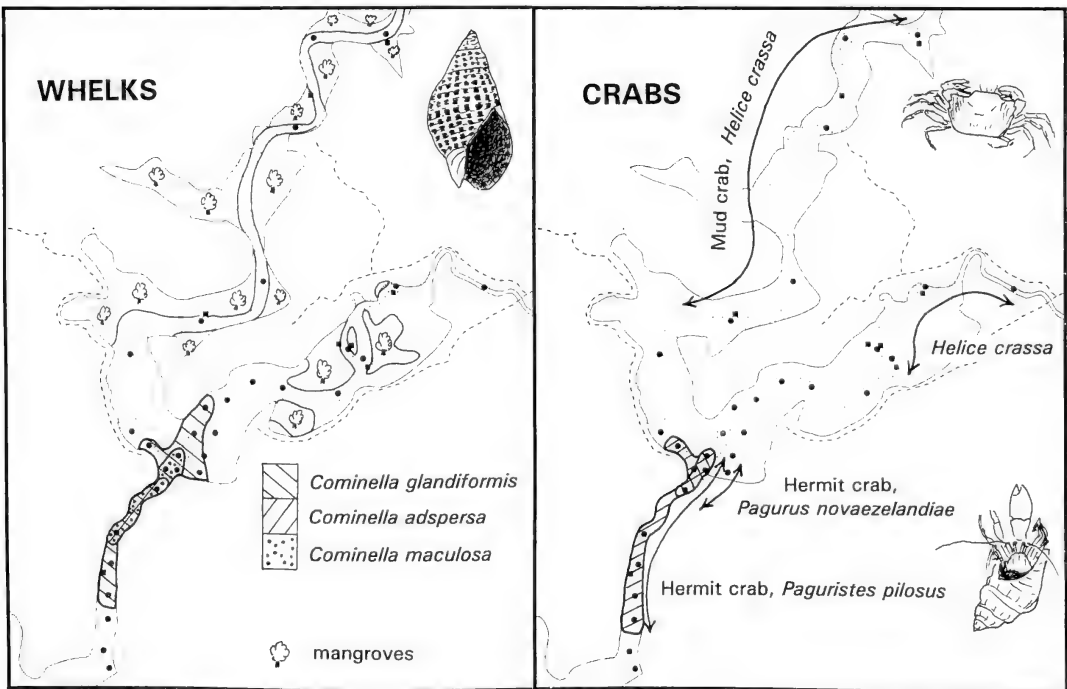


Fig. 4. Distribution in Whangape Harbour of whelks and crabs.

*Pagurus novaezelandiae* and *Paguristes pilosus* occur on pipi shell gravel and medium sand in the current-swept entrance channel. *Pagurus novaezelandiae* appears to prefer finer substrates in slightly less current swept conditions, at intertidal and shallow subtidal depths. *Paguristes pilosus* occurs commonly in shallow subtidal depths of 1-5 m. This is in contrast to its recorded range in Otago waters of 10-85 m (Schembri & McLay 1983). Studies around northern New Zealand show it to be common at shallow subtidal depths in many places (pers. obs.).

## DISCUSSION

### INTRODUCED SPECIES

The only introduced species recorded in Whangape is the Pacific oyster, which was found only in low numbers. In contrast to Waimamaku River estuary, a few kilometres to the south, Pacific oyster was not found living in the subtidal channels of either of Whangape Harbour's estuaries (Hayward & Hollis 1993). Harbours on the east coast of Northland and Auckland have been invaded by a number of introduced species in the last few decades. Exotic bivalves that have the potential to thrive in Whangape include the Asian mussel (*Musculista senhousia*), the thin-shelled *Theora lubrica* and *Limaria orientalis*.

### COMPARISONS WITH OTHER NORTHERN HARBOURS AND ESTUARIES

Whangape Harbour appears to have the lowest diversity of animal life living in and on the bottom sediments of all the previously studied harbours, large and small, in northern New Zealand. Many species common elsewhere are absent or insufficiently abundant to have been sampled during this study. These absent species include gastropods (*Amalda* spp., *Maoricolpus roseus*, *Zeacolpus pagoda*, *Zegalerus tenuis*), bivalves (*Dosinia* spp., *Gari* spp., *Myadorea* spp., *Ruditapes largillierii*), heart urchins (*Echinocardium cordatum*), crabs (*Halicarcinus varius*, *Hemigrapsus crenulatus*, *Macrophthalmus hirtipes*, *Petrolisthes* spp.) and worms (*Axiiothella* spp., *Aglaophamus macrura*, *Pectinaria australis*).

The abundance of the sand dollars and hermit crabs *Paguristes pilosus* and *Pagurus novaezelandiae* on the current-swept floor of Whangape entrance channel has parallels with the low diversity *Pagurus-Fellaster* community inhabiting the well-sorted fine sand in the Manukau Harbour entrance channel (Grange 1979). The dominance of pipi living in a pipi shell hardground throughout the length of Whangape's narrow, 4 m deep entrance channel is a feature also observed in the narrow current-swept, subtidal entrance channel to Whangateau Harbour (Grace 1966). Elsewhere pipi form dense intertidal and low tidal beds in the mouths of many tidal estuaries around New Zealand (pers. obs.).

The most diverse fauna in Whangape Harbour occurs in the shallow central basin. The dominant organisms (*Cominella glandiformis*, *C. maculosa*, *Tellina liliana*, *Nucula hartvigiana*, *Austrovenus stutchburyi*, *Paphies australis*, *Paguristes pilosus*, *Anthopleura aureoradiata*, *Glycera* sp., *Owenia fusiformis*) are all common elements of the shallow subtidal fauna of the channels and basins in inlets around the sheltered, somewhat brackish, upper reaches of Manukau, Waitemata and Tutukaka harbours (Grange 1982, Brook *et al.* 1981), although the diversity at Whangape is considerably less than in these larger harbours.

Cockles and pipi occur as community dominants in close association in many brackish estuaries and harbour inlets throughout New Zealand (e.g. Grange 1982, Hayward & Hollis 1993). Their distribution patterns suggest that both have similar salinity requirements, although cockles show a greater tolerance of muddy conditions. Whangape Harbour provides one of the clearest examples so far studied, of the influence of substrate on the distribution of these cockles and pipi. Cockles are dominant in the finer sandy mud and pipi in the cleaner pebbly sand and shell gravel.

In summary, the fauna of Whangape Harbour is more typical of a large estuary than a harbour. Only the outer part of the entrance channel with its abundant sand dollars, has features more usually found in harbours.

*Acknowledgements.* We thank Fred Brook, Michael Eagle and Clare Ward for assistance during dredge sampling. The manuscript has benefitted from the critical review of Fred Brook. Field work was financed by the C.H. Worth Fund of the Auckland Institute and Museum.

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BRUCE W. HAYWARD and A. BRETT STEPHENSON, Auckland Institute and Museum, Private Bag 92018, Auckland. WILMA BLOM, 61A Mt Roskill Rd, Mt Roskill, Auckland. MARGARET MORLEY, 25 The Boulevard, Pakuranga, Auckland. CHRIS J. HOLLIS, c/o Institute of Geological and Nuclear Sciences, P.O. Box 30368, Lower Hutt.

APPENDIX 1. Whangape Harbour sample station data with Auckland Museum Marine Departments' sample catalogue numbers. LT = low tide, MT = mid tide, HT = high tide.

Stn.	Cat.No.	Depth (m)	Sediment type
1	L1293	4	medium to coarse sand
2	L1294	4	medium to coarse sand
3	L1295	4	medium sand
4	L1296	3.5	pipi shell gravel
5	L1291	LT	slightly muddy, pebbly coarse sand
6	L1292	4	pipi shell gravel
7	L1297	4	pipi shell gravel
8	L1298	5	shelly coarse sand
9	L1270	5	shelly medium sand
10	L1271	5	medium sand
11	L1272	0.5	mud
12	L1299	1.5	slightly shelly, medium to fine sand
13	L1273	0.3	muddy very fine sand
14	L1274	2	medium sand
15	L1275	LT	fine sandy mud
16	L1276	2	fine sandy mud
17	L1277	1.5	slightly muddy medium sand
18	L1278	2	muddy fine sand
19	L1279	2	slightly muddy, pebbly medium sand
20	L1280	1.5	slightly muddy, pebbly medium sand
21	L1290	MT	mud
22	L1289	0.5	pebbly, muddy fine sand
23	L1287	0.5	muddy fine sand
24	L1286	HT	slightly sandy mud
25	L1288	HT	medium sand
26	L1285	HT	muddy clay
27	L1284	0.5	coarse sand
28	L1283	3	slightly muddy, pebbly coarse sand
29	L1281	HT	pebbly coarse sand
30	L1300	2	fine sand
31	L1301	2.5	mud
32	L1302	3	slightly sandy, shelly mud
33	L1310	1.5	slightly shelly, slightly sandy mud
34	L1311	MT	mud
35	L1303	2.5	sandy mud
36	L1309	2	mud
37	L1304	MT	mud
38	L1308	0.5	fine sandy mud
39	L1307	2	pebbly mud
40	L1305	HT	clay

APPENDIX 2. Species recorded in Whangape Harbour survey stations. Number of specimens is given in brackets after the station number, p = present in non-quantitative intertidal stations.

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#### AMPHINEURA

*Chiton glaucus* 8(2),12(10)  
*Ischnochiton maorianus* 8(1)  
*Rhyssoplax aerea* 4(1),8(5)

#### GASTROPODA

*Amphibola crenata* 24(p),25(p),26(p),34(p)  
*Cominella adspersa* 7(2),8(1)  
*Cominella glandiformis* 4(3),7(1),10(2),11(1),12(6),16(1),30(1)  
*Cominella maculosa* 7(2),8(1),12(1)  
*Diloma subrostrata* 12(9)  
*Notoacmea helmsi* 12(3)  
*Potamopyrgus antipodum* 26(p)  
*Sigapatella novaezelandiae* 32(1)  
*Xymene ambiguus* 6(1)  
*Xymene plebeius* 8(1),10(2),12(1)

#### BIVALVIA

*Austrovenus stutchburyi* 9(1),11(2),12(1),13(9),15(18),16(23),  
 17(2),18(5),20(3),22(1),23(2),30(1),33(25),35(100),36(20),  
 38(3),39(2)  
*Crassostrea gigas* 6(1)  
*Felaniella zelandica* 30(1)  
*Mactra ovata* 35(2)  
*Notirus reflexus* 32(1)  
*Nucula hartvigiana* 8(15),9(1),11(45),13(11),15(2),30(10),31(5),  
 32(5),33(5)  
*Paphies australis* 4(15),5(50),6(8),7(30),8(120),10(150),12(15),  
 14(6),18(4),19(8),20(9),22(200),27(2),36(2)  
*Tellina liliana* 9(1),13(4),15(3),16(2),31(1)

#### COELENTERATA

*Anthopleura aureoradiata* 10(5),16(1)

#### ANNELIDA

*Glycera americana* 9(1)  
*Glycera tessellata* 32(1)  
*Lepidonotus polychromus* 6(2)  
*Lumbrineris aotearoae* 32(1)  
*Owenia fusiformis* 31(2)  
*Pherusa parmata* 6(1)  
*Streblosoma ?gracile* 6(1)

#### CRUSTACEA

*Cyclograpsus lavauxi* 12(3),35(3)  
*Helice crassa* 22(15),24(p),25(p),26(p),29(p),34(p),37(p),40(p)  
*Liocarcinus corrugatus* 4(1),35(3)  
*Paguristes pilosus* 3(2),4(5),6(1),12(2),30(4)

*Pagurus novaezelandiae* 8(2),12(2)

*Pontophilus chiltoni* 35(1)

isopod indet. 1(1)

ECHINODERMATA

*Fellaster zelandica* 1(20),2(1)

PISCES

*Trachelochismus pinnulatus* 12(2)

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# FORAMINIFERAL ASSOCIATIONS AROUND NORTHERN GREAT BARRIER ISLAND, NEW ZEALAND

BRUCE W. HAYWARD AND HUGH R. GRENFELL

*Abstract.* Census data on benthic foraminiferal tests in 60 seafloor sediment samples (high tide to 68 m depth; slightly brackish to normal marine) around northern Great Barrier Island, are analysed by cluster analysis. The faunal samples are grouped into eight associations. Characterising species of each association are found by calculating "association scores" for each species, based on its abundance, relative abundance, fidelity, persistence and dominance within each association. The foraminiferal associations are: A. *Ammonia beccarii*/*Elphidium excavatum* - intertidal and shallow subtidal, sheltered, slightly brackish environments, 0-5 m; B. *Quinqueloculina seminula*/*Miliolinella subrotundata* - shallow subtidal, moderately sheltered, gravelly sand, 2-17 m; C. *Elphidium charlottensis*/*Haynesina depressula* - shallow subtidal sand, 4-16 m; D. *Nonionella flemingi*/*Bolivina pseudoplicata* - muddy sediment in quiet inner shelf depths, 12-35 m; E. *Gaudryina convexa*/*Discorbis dimidiatus* - moderately exposed sand at 1-28 m; F. *Discorbis dimidiatus*/*Rosalina irregularis* - sand at 3-33 m in Rangiwahakaea Bay; G. *Gaudryina convexa*/*Bulimina submarginata* - wide range of sediment types, at 23-58 m depths on the exposed coast; H. *Bulimina submarginata*/*Hanzawaia bertheloti* - fine sand at mid shelf depths, >50 m.

In the cluster analysis dendrogram, the first order division splits the slightly brackish association A off from the remaining normal salinity associations. The second order division splits the normal salinity faunas into an eastern, more diverse, more oceanic group (E-H) and a western, more neritic group (B-D). The third order divisions split the oceanic and neritic groups into associations, presumably determined by a combination of other environmental factors, such as substrate type, energy regime, light penetration. The dominant foraminiferal species are grouped by cluster analysis into seven species associations. These correlate quite closely with the sample associations, with only two species associations being prevalent in more than one sample association. Planktics comprise 15-20% of the foraminiferal fauna in exposed situations (25-70 m depth) on both sides of northern Great Barrier Island, but the planktic associations are distinctly different. On the northeast side, the planktics are diverse in size range and taxonomic composition and indicate shoreward movement and input from the oceanic plankton offshore. On the northwest side, the planktics are all small and of low taxonomic diversity, dominated by *Globigerina falconensis* and *G. quinqueloba*, typical of nearshore neritic plankton.

Knowledge of the ecological distribution of shallow-water benthic foraminifera (Protista, Protozoa) has applications in both modern and fossil environmental studies. An understanding of modern foraminiferal patterns can be used in interpreting fossil foraminiferal faunas and allow micropaleontologists to make relatively accurate assessments of paleodepth, paleosalinity and paleoenvironments, that are useful in paleogeographic reconstruction. Fossil shallow water benthic foraminiferal faunas are of special relevance to modern methods of determining rates of Quaternary uplift, changes in sealevels and climate, and in the study and quantification of Cenozoic cyclothems, sequence stratigraphy and geohistory analysis.

This study is the third part of a six part programme, designed to document the ecological distribution patterns of modern shallow water (brackish and inner shelf) foraminifera around

New Zealand. The programme consists of six quantitative studies - two in each of the northern, central and southern regions of New Zealand. In each region, one study area is in an enclosed, largely brackish harbour and estuary, and one study area is largely in normal salinity habitats, both enclosed and open water. This Great Barrier study is of normal salinity environments in

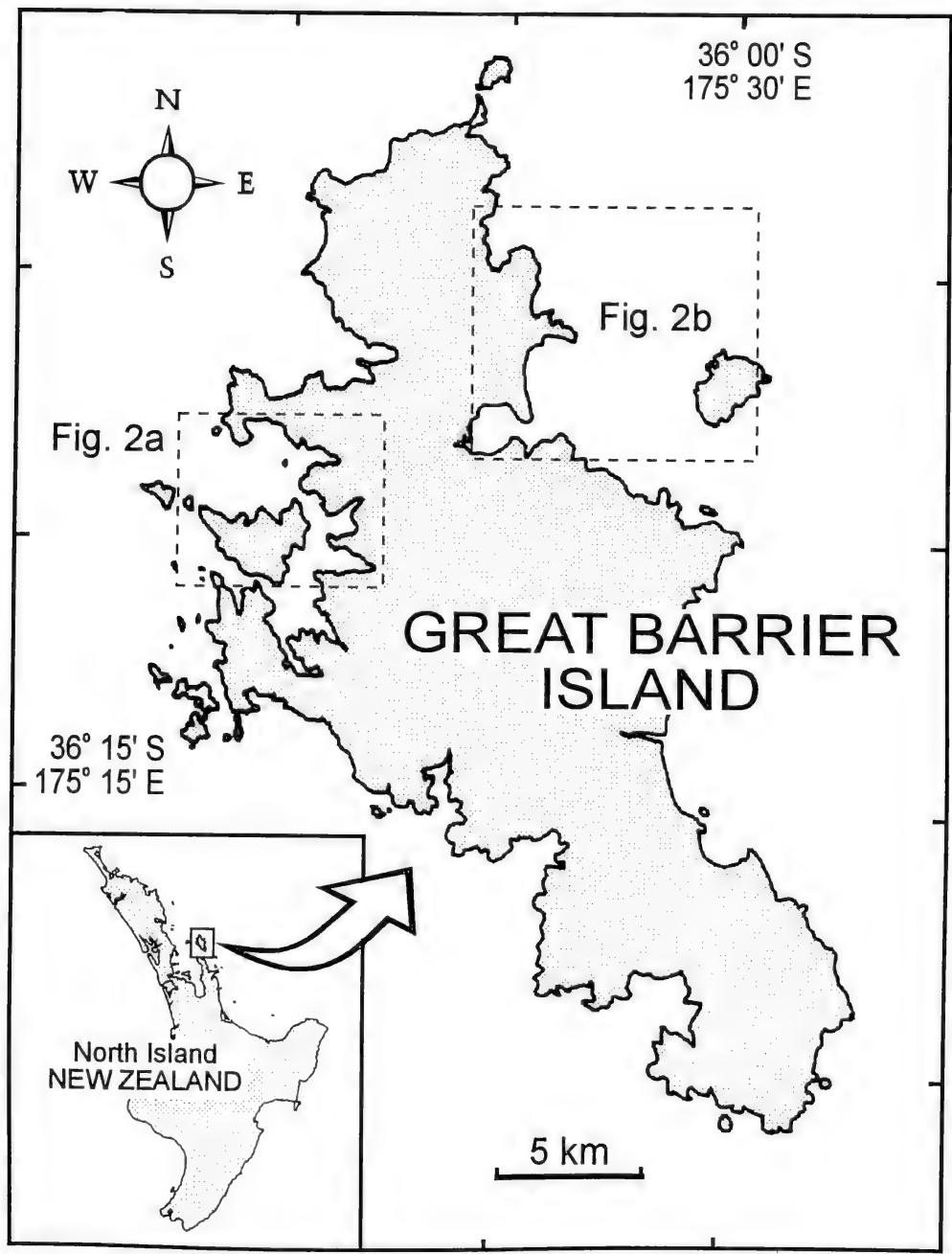


Fig. 1. Location map showing studied areas on Great Barrier Island.

the northern region. Studies completed so far are of normal salinity foraminifera in the south (Port Pegasus, Stewart Island - Hayward *et al.* 1994) and brackish harbour foraminifera in the central region (Pauatahanui Inlet - Hayward & Triggs 1994).

Other studies on New Zealand's shallow water foraminifera have documented their quantitative distribution in various normal salinity environments around the Cavalli Islands, eastern Bay of Islands and Chicken Islands (Hayward 1981, 1982a; Hayward *et al.* 1984), all 50-170 km northwest of Great Barrier Island. Lewis (1979) and Vella (1957) documented foraminiferal distribution in shelf and bathyal depths off the east and west coasts respectively of the southern North Island. Gregory (1973) described the intertidal foraminifera from a mangrove swamp at the head of Whangapara Harbour, southern Great Barrier Island.

This paper describes the benthic foraminiferal associations in 60 surface sediment samples from both sides of northern Great Barrier Island (latitude 36° 10'S, longitude 175° 20'E), New Zealand (Fig. 1). Twenty-four samples are from northwest Great Barrier - 11 from Port Abercrombie, 13 from Port Fitzroy; and 36 are from the northeast side between Rangiwhakaea Bay and Rakitu Island (Fig. 2, Appendix 1). The samples come from a broad range of inner and mid shelf environments (mid tide to 68 m depth) extending from sheltered, slightly brackish conditions at the head of arms in Port Fitzroy (stn. 21) through to normal salinity and exposure to the full force of the Pacific Ocean on the northeast coast of Great Barrier.

Port Abercrombie is a 3 km wide, 5 km long, semi-enclosed bay on the west coast of northern Great Barrier. It is 30-40 m deep except where it shallows steeply on the sides and more gradually at its head. Port Fitzroy is an elongate harbour (c. 7 x 2 km) enclosed by several peninsulas and Kaikoura Island. It is connected to the open sea via two narrow passages - Man of War Passage in the southwest and Fitzroy Passage in the north, which opens into Port Abercrombie. Most of Port Fitzroy is 15-30 m deep, though it shallows eastwards into its four narrow arms, each of which has extensive intertidal flats at their head. Considerable freshwater runoff flows via streams into the head of each of these arms especially after heavy rain, and lowers the salinity in the shallower surface water layers (Hickman 1979). Ports Fitzroy and Abercrombie are surrounded by moderately steep land, partly farmed, partly in kanuka scrub and partly in regenerating or mature native forest. The seasonal sea surface temperature range for these northwest ports is 13-23°C (Hickman 1979).

The east side of northern Great Barrier is less embayed than the west side and is exposed to northeast swells from the Pacific Ocean. Rangiwhakaea Bay, where some of the sampling was undertaken, is a small bay 1.5 km across, open to the northeast and mostly shallower than 20 m. Rakitu Island, 2.5 km in diameter, lies 3 km offshore and provides some shelter to parts of this coast. A small enclosed cove (200 x 400 m) on the north coast of Rakitu Island provides the most sheltered environment sampled on this coast. The seafloor off northeast Great Barrier slopes gently seaward reaching 60 m depth, 2-3 km offshore.

## SEDIMENTS

Grain size terminology follows Folk (1968). Sediment types at dredge stations are listed in Appendix 1, and their distribution shown in Fig. 3. The two areas studied have different environmental regimes with the Port Fitzroy/Port Abercrombie area being mostly a lower

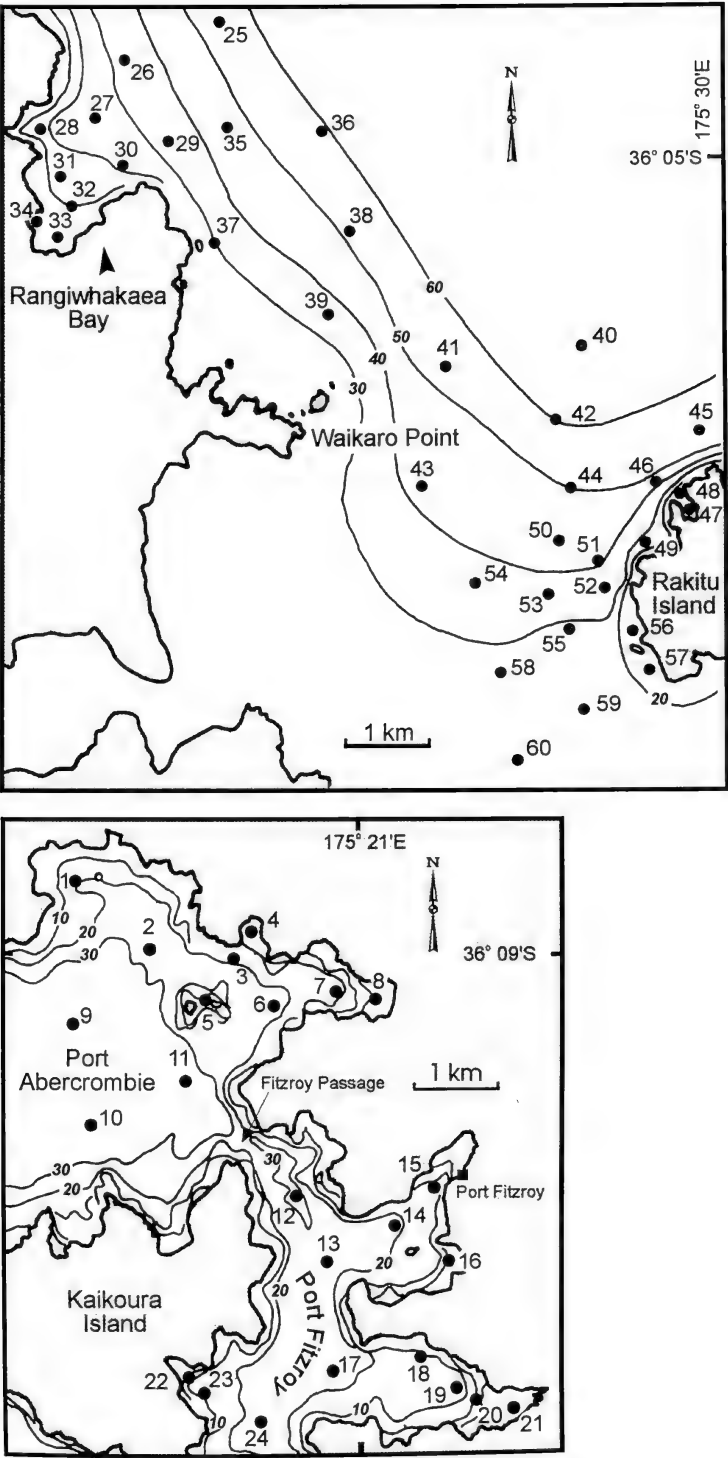


Fig. 2. Foraminiferal sediment sample locations and depth contours in Port Fitzroy and Port Abercrombie (below) and off northeastern Great Barrier Island (above).

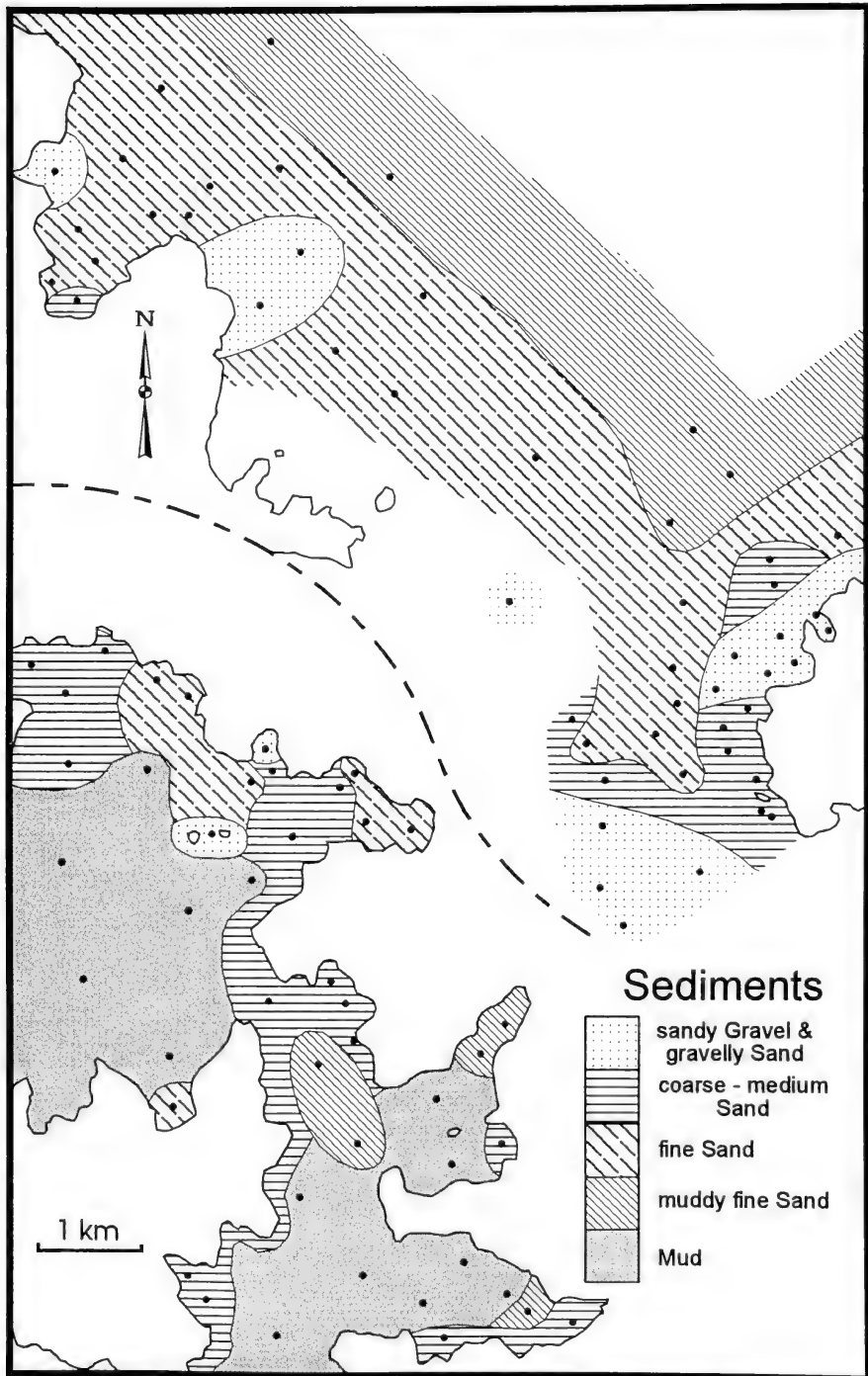


Fig. 3. Simplified sediment distribution maps of the two study areas, northern Great Barrier Island.

energy, sheltered, enclosed harbour, whereas the northeast area is largely a high energy, open marine situation. The coast of the Port Fitzroy/Port Abercrombie area is mostly rocky with small pocket beaches. The seafloor is predominately covered by muds. The deep, tidal Fitzroy Passage has medium and muddy fine sands. Areas of fine sand occur close to shore in the northern part of Port Abercrombie and in a small pocket in the south. Coarse and medium sands occur around the shoreline of both ports. Sandy gravel and gravelly sand are present only around small islands and off one pocket beach in northern Port Fitzroy.

Apart from the sandy shoreline south of Waikaro Point, the coast of the northeast area is rocky with small pocket beaches. The dominant sediments are a wide offshore strip of muddy fine and fine sand which extends into Rangiwhakaea Bay and as a tongue down the west side of Rakitu Island. Areas of sandy gravel and gravelly sand are present immediately offshore in the Rangiwhakaea Bay area, around the northwest coast of Rakitu Island and to the southwest of the island. A large area of coarse and medium sand occurs from the southwest coast of Rakitu Island westward. Pockets also occur in deep water (55 m) just northwest of Rakitu Island and inside Rangiwhakaea Bay.

## SPECIMENS AND DATA

Faunas from northeast Great Barrier are deposited in the Micropaleontology Section of the Institute of Geological and Nuclear Sciences (samples F201848-201880; F202040-202066). Faunas from Port Fitzroy and Port Abercrombie are deposited in the Auckland Institute and Museum (L2803-2844). Figured specimens (Figs 4-32) are held by the Institute of Geological and Nuclear Sciences (catalogue numbers prefixed by FP). Copies of the raw data have been deposited with both the above institutions and is available on request.

## METHODS

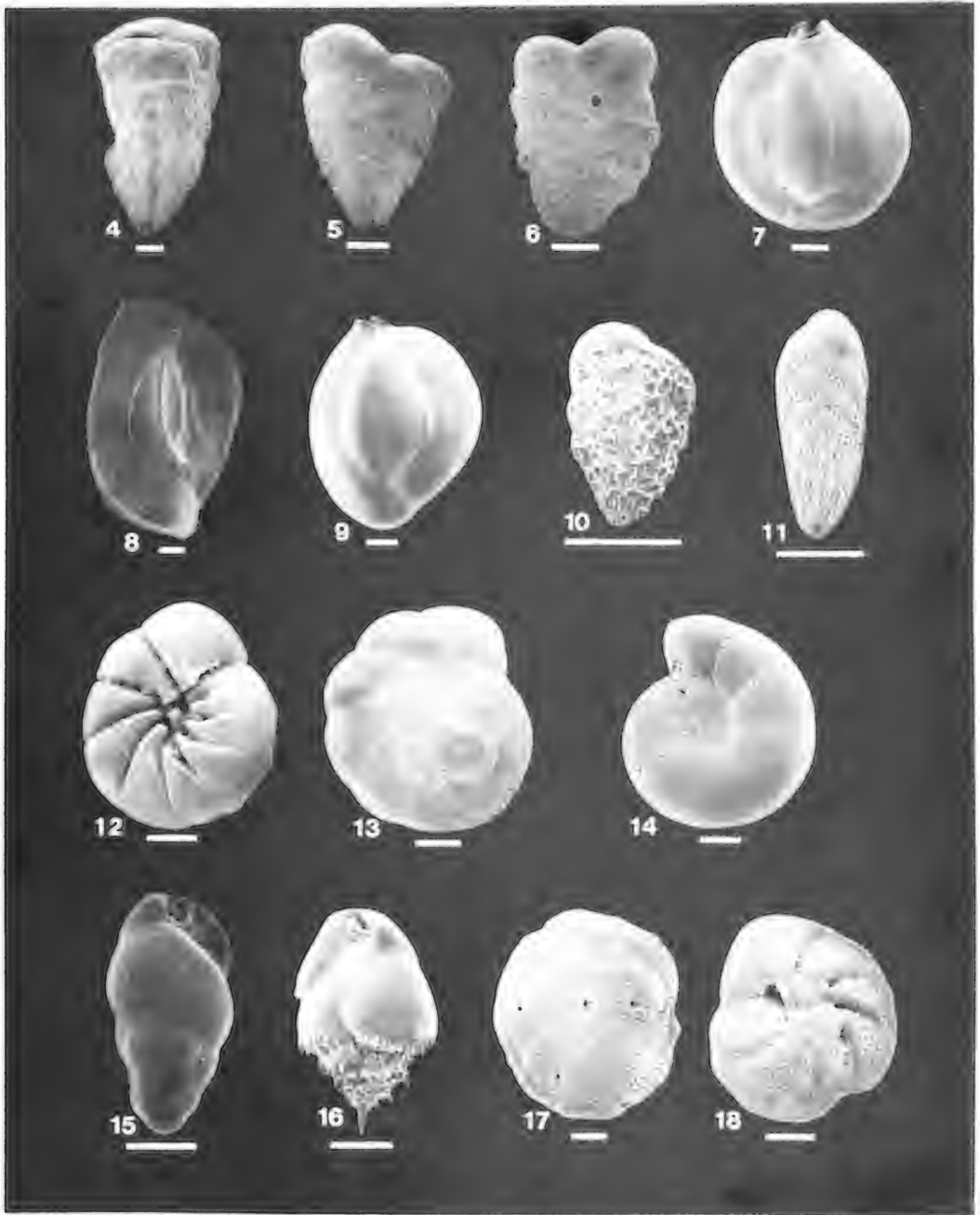
### FIELD

Samples were collected using small, 4-10 litre capacity bucket dredges, hand-hauled from a 4 m aluminium dinghy powered by a 7 horse power outboard motor. The sea floor sediment was sampled to a depth of 50-100 mm. Sampling was undertaken during Offshore Islands Research Group trips to Rakitu Island in January 1981 and to Rangiwhakaea Bay in January 1983, and during an Auckland Museum trip to Port Fitzroy in February 1993.

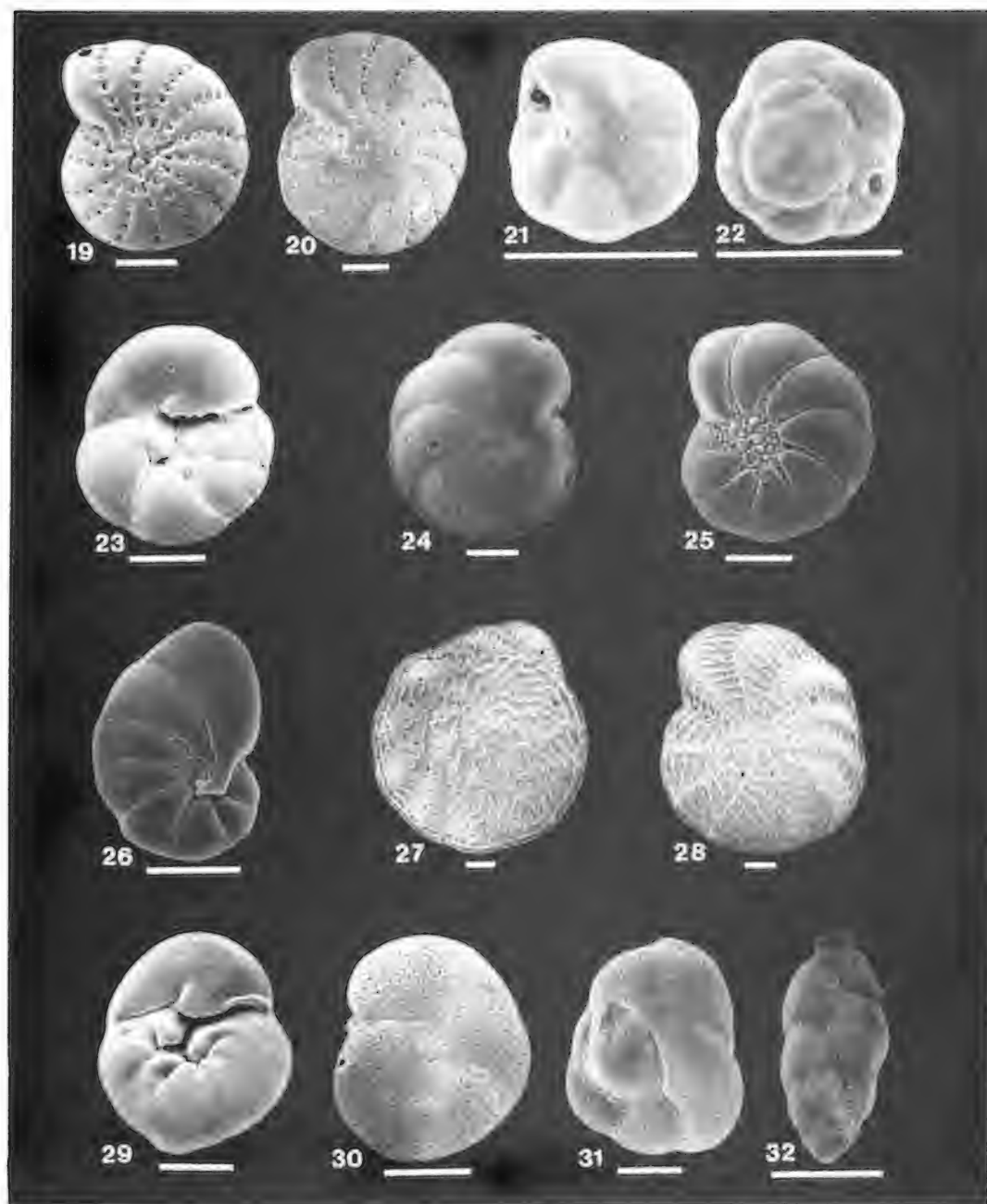
### LABORATORY

Grain size analysis of each sample was by dry sieving (Folk 1968). The mud fraction ( $<0.06$  mm) was washed away and foraminifera concentrated by floatation with carbon tetrachloride. The dried float from each sample was divided using a microsplitter until the quantity of material left contained approximately 100 benthic foraminifera which were then picked, mounted, identified and counted. Planktic foraminifera encountered during the benthic pick were identified and counted. The remaining unpicked float from a range of samples was subsequently quickly scanned and specimens of any additional rarer taxa were picked to give a more complete species list (Appendix 2).

In previous studies we have found that picking just 100 benthic foraminifera provides a



Figs 4-18. Scanning electron micrographs of characterising and more common foraminifera of northern Great Barrier Island. 4. *Gaudryina convexa*, Stn 58, FP4276. 5. *Textularia ensis*, Stn 51, FP4277. 6. *Textularia proxispira*, Stn 45, FP4278. 7. *Miliolinella subrotundata*, Stn 1, FP4279. 8. *Quinqueloculina colleenae*, Stn 1, FP4280. 9. *Quinqueloculina seminula*, Stn 1, FP4281. 10. *Bolivina pseudoplicata*, Stn 9, FP4282. 11. *Bolivina striatula*, Stn 9, FP4283. 12-13. *Ammonia beccarii*, Stn 8, FP4284-5. 14. *Anomalina spherica*, Stn 40, FP4286. 15. *Bulimina gibba*, Stn 47, FP4287. 16. *Bulimina submarginata*, Stn 40, FP4288. 17-18. *Discorbis dimidiatus*, Stn 34, FP4289-90. Scale bar 0.1 mm.



Figs 19-32. Scanning electron micrographs of characterising and more common foraminifera of northern Great Barrier Island. 19. *Elphidium excavatum*, Stn 21, FP4291. 20. *Elphidium charlottensis*, Stn 3, FP4292. 21-22. *Epistominella vitrea*, Stn 10, FP4293-4. 23. *Gavelinopsis lobulatus*, Stn 40, FP4295. 24. *Hanzawaia bertheloti*, Stn 40, FP4296. 25. *Haynesina depressula*, Stn 9, FP4297. 26. *Nonionella flemingi*, Stn 10, FP4298. 27-28. *Notorotalia olsoni*, Stn 9, FP4299-4300. 29-30. *Rosalina bradyi*, Stn 30, FP4301-4302. 31. *Rosalina irregularis*, Stn 27, FP4303. 32. *Siphouvigerina glabra*, Stn 19, FP4304. Scale bar 0.1 mm.



sufficiently accurate assessment of faunal composition for use in identifying and mapping associations. The computer programmes employed are primarily influenced by the dominants in each fauna and picks of 100 specimens readily identify these. The extra work in picking 200 or 300 benthics is unjustified in a study of this sort.

## STATISTICAL

The data consist of counts of 195 species in 60 samples. The data matrix was standardised by converting counts to proportions of sample totals. Unweighted pair group cluster analysis using arithmetic averages of a Bray-Curtis distance matrix was used to produce a dendrogram classification of samples (Fig. 33) from which sample associations were selected. Similar cluster analysis of a distance matrix produced using Horn's (1966) modified version of Morista's (1959) index for proportions was used to produce a dendrogram classification of abundant species (>7% in any sample) from which species associations were selected (Fig. 34). Mathematical definitions of the Bray-Curtis and modified Morista coefficients are given in Sneath & Sokal (1973) and Rohlf (1989). The modified Morista index downweights the more abundant species and produces a more realistic clustering of species that commonly occur together. Cluster analyses were computed using the "NTSYS" statistical package (Rohlf 1989).

## ASSOCIATION SCORES

To determine which species characterise each of the faunal associations, the more abundant taxa were ranked for each association using a value (association score) calculated to reflect their importance, based on a combination of five criteria (modified after McCloskey (1970) and Grange (1979)):

1. **Dominance (Dom.)**, The 10 most abundant taxa of each station in an association were scored with most abundant species given a score of 10, the second most abundant a score of 9, and so on. The dominance of a taxon within an association is given by the mean score across all stations in that association.
2. **Fidelity (Fid.)**, or degree to which a taxon is restricted to an association expressed as the proportion of stations within the association in which the taxon occurs less the proportion of stations outside the association in which it occurs.
3. **Abundance (Abund.)**, given as the mean abundance of the taxon within the association.
4. **Relative abundance (Rel.)**, expressed as the mean abundance of the taxon within the association less its mean abundance throughout all the stations.
5. **Persistence (Pers.)**, given as the proportion of the stations within the association in which the taxon occurs.

The various criteria were weighted and combined to give an empirical association score for each species in each association, with a maximum value of 100 (Appendix 3). Association scores were calculated using the formula:

Assoc. Score =  $4(0.3 \text{ Dom} + 2 \text{ Fid} + 0.11 \text{ Abund} + 0.08 \text{ Rel} + \text{Pers})$ .

Weightings have been assigned to each criterion to make their values more nearly equal, but giving greater weight to some criteria in the following decreasing order: Abundance, Relative abundance, Dominance, Fidelity, Persistence.

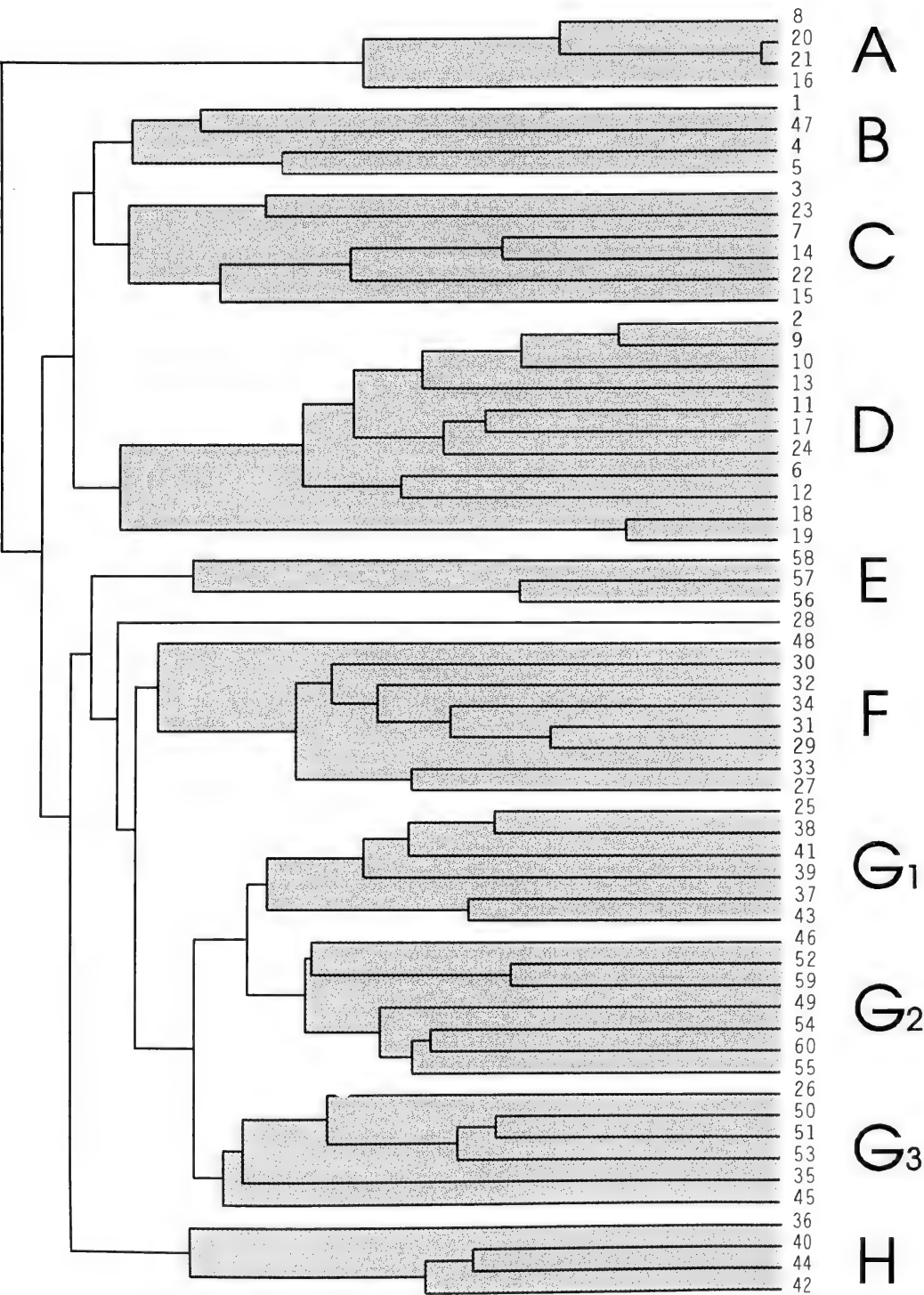


Fig. 33. Dendrogram classifications of northern Great Barrier Island foraminiferal samples produced by cluster analysis using Bray-Curtis distance matrix (Rohlf 1989). The eight sample associations (A-H) were selected by the authors, after inspection of the dendrograms.

## SPECIES DIVERSITY

Species diversity was calculated for each fauna (Appendix 1), and also the mean values for each of the associations, using the following measure:

Shannon-Wiener Information Function,  $H_{(S)} = \sum P_i \log_e P_i$ ,

where  $P_i$  is the proportion of the  $i$ th species (MacArthur & MacArthur (1961), Gibson and Buzas (1973)). Unlike the number of species ( $S$ ) in a sample, the Information Function places little weight on rarer and very abundant species. The value of  $H$  depends on a combination of the evenness of species counts, together (to a lesser extent) with the number of species present.

## SAMPLE ASSOCIATIONS

The following eight sample associations and three subassociations were selected by inspection from the cluster analysis dendrogram (Fig. 33) and their geographic distribution is shown in Fig. 35. The characterising species listed are those having the highest association scores (Appendix 3).

### Association A *Ammonia beccarii*/*Elphidium excavatum*

Stations : 8,16,20,21 = 4

Dominant species association : 1

Secondary species association : 2

Depth : mid tide-5.5 m

Sediment : muddy fine sand to gravelly coarse sand

Diversity : Information function  $H$ : 0.6-2.0, mean 1.3

This association occurs intertidally and in the shallow subtidal areas at the heads of the arms of Ports Abercrombie and Fitzroy. All localities are sheltered from all but minor wave exposure. Small streams empty into each of the arms and result in periodically lowered salinity in these stations, especially after heavy rain (Hickman 1979). The fauna is of low diversity and low equitability being dominated by *Ammonia beccarii* (mean abundance c. 60%) with the common subdominant *Elphidium excavatum* s.l. (mean abundance c. 15%). It has the lowest diversity of all the recognised associations in this study. This association is widespread throughout New Zealand and in other countries in sheltered and enclosed intertidal and shallow subtidal situations, often with slightly lowered salinity (Hayward & Hollis 1994).

### Association B *Quinqueloculina seminula*/*Miliolinella subrotundata*

Stations : 1,4,5,47 = 4

Dominant species association : 4

Depth : 2-17 m

Sediment : gravelly fine-medium sand to sandy gravel

Diversity : Information function  $H$ : 2.9-3.5, mean 3.2

This association occurs in gravelly sand and sandy gravel in shallow subtidal areas with normal salinity in moderately sheltered bays on the north side of Port Abercrombie and Rakitu Island and in the gravelly channel between two small islands in the middle of Port Abercrombie. The fauna is codominated by *Quinqueloculina seminula*, *Miliolinella subrotundata* and *Elphidium charlottensis* (each c. 8-10% mean abundance). *Bolivina pseudoplicata*, *Pileolina zelandica*, *Haynesina depressula* and *Notorotalia olsoni* (each c. 5-

6% mean abundance) are subdominant. *Q. seminula*, *M. subrotundata* and *P. zelandica* occur in their greatest abundances in this association. This association has many similarities to faunas recorded from shelly fine to medium sand at 4-10 m in the lee of Whale Island, Bay of Plenty (Hayward 1990) and to the *Elphidium charlottensis* - *Patelinella inconspicua* - *Quinqueloculina seminula* association that occurs at 0-10 m depth in the current-swept mouth and entrance channel of Pauatahanui inlet, Wellington (Hayward & Triggs 1994).

**Association C *Elphidium charlottensis*/*Haynesina depressula***

Stations : 3,7,14,15,22,23 = 6

Dominant species association : 2

Secondary species associations : 1,3

Depth : 4-16 m

Sediment : muddy fine sand to slightly gravelly medium-coarse sand

Diversity : Information function H: 1.9-3.0, mean 2.6

This association occurs in shallow subtidal sand around the fringes of Ports Abercrombie and Fitzroy. The fauna is codominated by *Elphidium charlottensis* and *Haynesina depressula* (each c. 16-18% mean abundance) with subdominant *Notorotalia olsoni*, *Ammonia beccarii* and *Quinqueloculina seminula* (each c. 5-8% mean abundance). *Bulimina gibba* and *Bolivina compacta* are other characterising species because of their high fidelity and relative abundance values. *E. charlottensis*, *H. depressula* and *N. olsoni* are significantly more abundant in this association than any other (Figs 34, 36). This association has previously been recognised along the east coast of Northland, in slightly gravelly fine sand at 2.5 m depth in Tutukaka Harbour (Brook *et al.* 1981) and in fine sand to sandy gravel at 0-6 m in sheltered bays of the Cavalli Islands (Hayward 1982a).

**Association D *Nonionella flemingi*/*Bolivina pseudoplicata***

Stations : 2,6,9,10,11,12,13,17,18,19,24 = 11

Dominant species association : 3

Secondary species association : 2

Depth : 12-35 m

Sediment : mud to slightly shelly muddy fine sand

Diversity : Information function H: 2.2-3.2, mean 2.7

This association occurs in fine-grained sediment in moderately quiet inner shelf areas at depths of 12-35 m in Ports Abercrombie and Fitzroy. The fauna is dominated by *Nonionella flemingi* (mean abundance c. 22%) with subdominant *Bolivina pseudoplicata*, *Elphidium charlottensis*, *Bulimina submarginata* and *Epistominella vitrea* (each c. 7-10% mean abundance). *Bolivina striatula* and *Siphouvigerina glabra* are also characterising species because of their high fidelity to this association. *N. flemingi*, *B. pseudoplicata* and *E. vitrea* (=species association 3) have their greatest abundances in this association (Figs 34, 37). A similar association, codominated by *Nonionella flemingi* but with more abundant *Notorotalia* and *Quinqueloculina finlayi*, has been described from identical sediment type in similar sheltered, deep, enclosed bays (22-30 m depth) at Port Pegasus, Stewart Island (Hayward *et al.* 1994) and has also been noted in similar environments in the Marlborough Sounds (Vella 1957).

**Association E *Gaudryina convexa*/*Discorbis dimidiatus***

Stations : 56,57,58 = 3

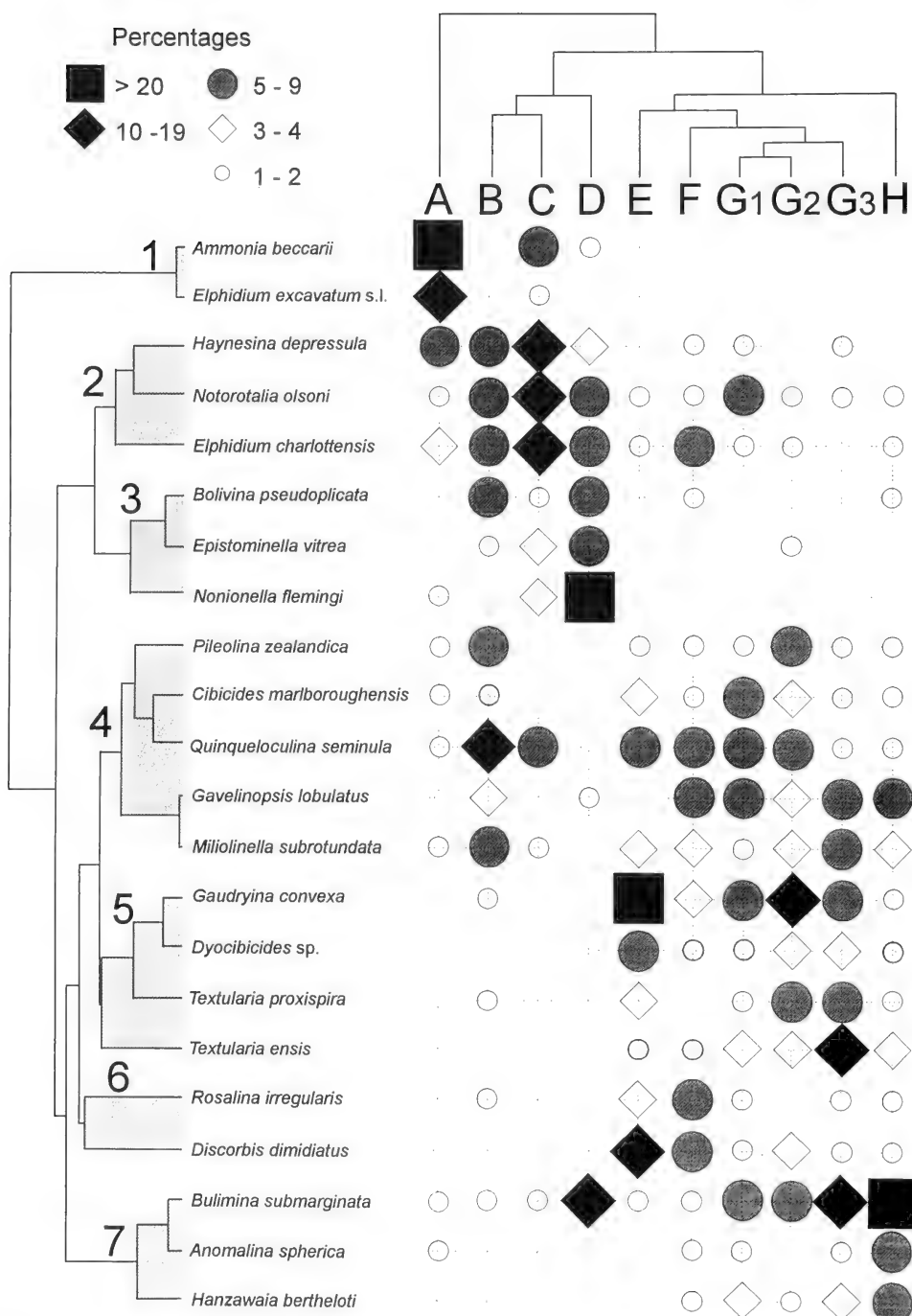


Fig. 34. Dendrogram classifications of northern Great Barrier Island foraminiferal associations (summarised after Fig. 33, top) produced by cluster analysis using Bray-Curtis distance, and of foraminiferal species (left) produced by cluster analysis using modified Morista distance (Rohlf 1989). The eight sample associations (A-H) and seven species associations (1-7) were selected by the authors, after inspection of the dendrograms. The relative abundance of each species in each sample is summarised in the chart.

Dominant species associations : 5,6

Secondary species association : 4

Depth : 1-28 m

Sediment : medium sand to slightly gravelly medium sand

Diversity : Information function H: 2.3-2.8, mean 2.6

This association occurs in medium sand close to the rocky shore of southwest Rakitu Island and in the channel between Rakitu and Great Barrier Islands. The fauna is dominated by *Gaudryina convexa* and *Discorbis dimidiatus* (mean abundances c. 23 and 16% respectively). *Quinqueloculina seminula* and *Dyocibicides* sp. are subdominant (each c. 7-8% mean abundance). *G. convexa*, *D. dimidiatus* and *Dyocibicides* sp. have their greatest abundances in this association (Figs 34, 38, 39). This association has a distinctly lower diversity than the surrounding association G. Similar associations to this have previously been recorded from a wide depth range from medium sand in exposed locations close to rocky islands along the east coast of northern New Zealand, at 2-28 m off the Cavalli Islands (Hayward 1982a) and at 6-37 m off Cuvier Island (Hayward & Grace 1981).

Association F *Discorbis dimidiatus/Rosalina irregularis*

Stations : 27,29,30,31,32,33,34,48 = 8

Dominant species association : 6

Secondary species associations : 2,4

Depth : 3-33 m

Sediment : mostly fine sand, with minor gravelly coarse sand

Diversity : Information function H: 2.8-3.5, mean 3.3

This association is limited to and covers most of the floor of Rangiwhakaea Bay on the northeast side of Great Barrier Island. The fauna has high equitability with codominant *Discorbis dimidiatus*, *Rosalina irregularis*, *Elphidium charlottensis* and *Quinqueloculina seminula* (each c. 7% mean abundance). *Rosalina bradyi* and an undescribed glassy form of *Elphidium excavatum* are also characterising species because of their high fidelity values. *R. irregularis*, *R. bradyi* and *E. excavatum* new form have their greatest abundance in this association (Figs 34, 39). Associations similar to this, except for their greater abundance of *Pileolina zealandica*, have previously been recorded in fine to coarse sand in moderately exposed locations off east Northland at 5-35 m depth off the Chickens Islands (Hayward *et al.* 1984) and 4-10 m depth off Little Barrier Island (Hayward 1982b).

Association G *Gaudryina convexa/Bulimina submarginata*

Stations : 25,26,35,37,38,39,41,43,45,46,49,50,51,52,53,54,55,59,60 = 19

Dominant species associations : 4,5,7

Depth : 23-58 m

Sediment : slightly muddy fine sand to coarse sandy pebble gravel

Diversity : Information function H: 2.7-3.5, mean 3.2

This association occurs in a wide range of sediment types in deeper inner shelf areas on the northeast side of Great Barrier Island. The fauna is a varied mix of species, codominated by *Gaudryina convexa* and *Bulimina submarginata* (mean abundance 7-8%) with subdominant *Textularia ensis*, *T. proxispira*, *Quinqueloculina seminula*, *Gavelinopsis lobatulus*, *Miliolinella subrotundata*, *Cibicides marlboroughensis* and *Dyocibicides* sp. (each c. 4-6%

mean abundance). The nineteen stations in this association can be divided into three subassociations using the cluster analysis (Fig. 33). *T. ensis*, *T. proxispira* and *C. marlboroughensis* have their greatest abundance in this association (Figs 34, 38).

Subassociation G1 *Quinqueloculina seminula/Bulimina submarginata*

Stations : 25,37,38,39,41,43 = 6

Dominant species associations : 4,7

Secondary species association : 5

Depth : 30-56 m

Sediment : slightly muddy fine sand to gravelly very coarse sand

Diversity : Information function H: 3.1-3.4, mean 3.2

This subassociation generally occurs in deeper, more exposed parts of the area, shoreward of the deeper association H. The fauna is codominated by *Quinqueloculina seminula* and *Bulimina submarginata* (each c. 8% mean abundance). Subdominants include *Gavelinopsis lobatulus*, *Quinqueloculina parvaggluta*, *Cibicides marlboroughensis*, *Notorotalia olsoni*, *Hanzawaia bertheloti* and *Gaudryina convexa* (each c. 4-6%). Of these, only *C. marlboroughensis* has its greatest abundance in this subassociation (Fig. 34). This subassociation is similar to the *Cibicides marlboroughensis* - *Quinqueloculina seminula* - *Notorotalia olsoni* association (B3 of Hayward 1982a) that occurs in medium to very coarse sand at 4-40 m depth around the Cavalli Islands.

Subassociation G2 *Gaudryina convexa/Textularia proxispira*

Stations : 46,49,52,54,55,59,60 = 7

Dominant species associations : 4,5

Depth : 23-51 m

Sediment : mostly gravelly coarse sand and coarse sandy pebble gravel, with minor fine and medium sand

Diversity : Information function H: 2.9-3.5, mean 3.2

This subassociation occurs in coarse sediments off the west coast of Rakitu Island and in the wide channel between Rakitu and Great Barrier Islands. The fauna is dominated by *Gaudryina convexa* (mean abundance c. 11%), with numerous subdominants - *Textularia proxispira*, *T. ensis*, *Quinqueloculina seminula*, *Pileolina zelandica*, *Dyocibicides* sp., *Cibicides marlboroughensis*, *Gavelinopsis lobatulus* and *Bulimina submarginata* (each c. 4-6% mean abundance).

Subassociation G3 *Bulimina submarginata/Textularia ensis*

Stations : 26,35,45,50,51,53 = 6

Dominant species associations : 4,5,7

Depth : 34-58 m

Sediment : mostly slightly muddy fine sand, minor slightly muddy very coarse sand

Diversity : Information function H: 2.7-3.5, mean 3.1

This subassociation generally occurs in slightly muddy fine sand between subassociation G2 and association H off the west coast of Rakitu Island and between associations F and G1 across the entrance to Rangiwhakaea Bay. The fauna is codominated by *Bulimina submarginata* and *Textularia ensis* (each c. 11-13%) with subdominant *Miliolinella subrotundata*, *Gaudryina*

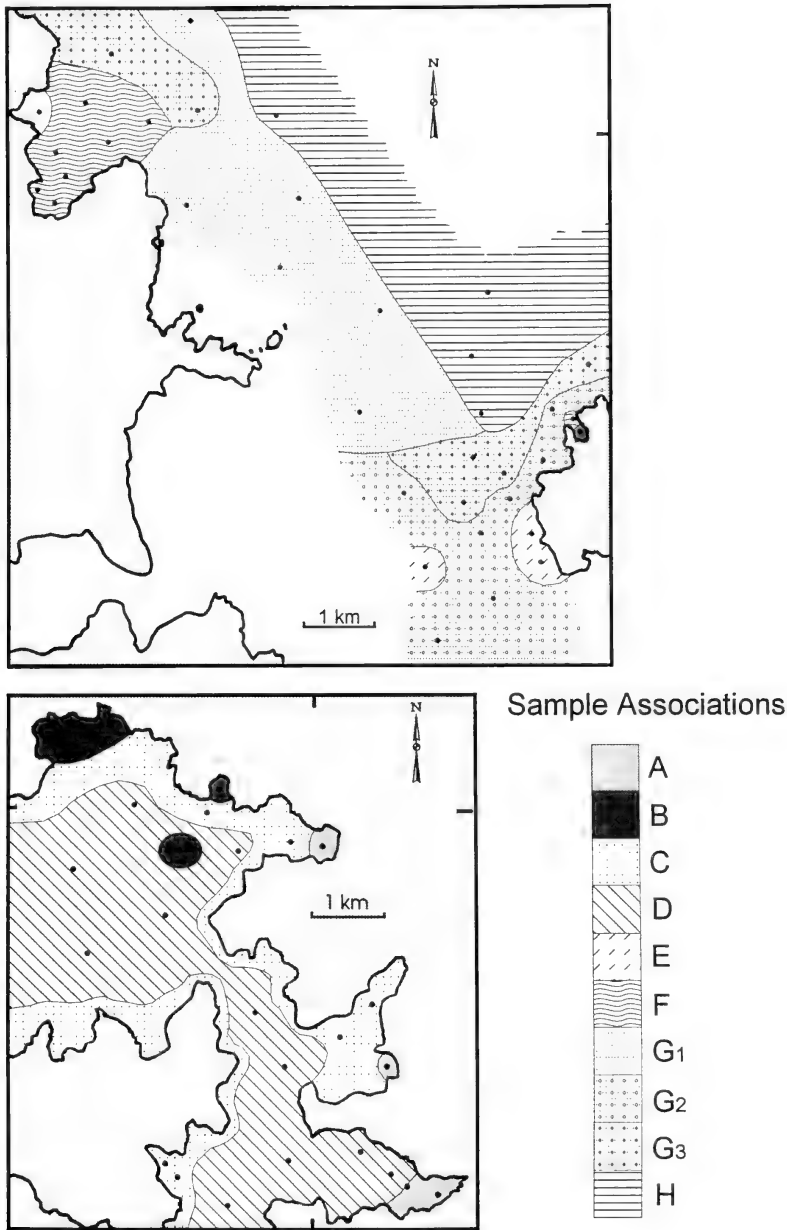


Fig. 35. Distribution of the eight benthic foraminiferal sample associations and three subassociations of northern Great Barrier Island. Association A = *Ammonia beccarii*/*Elphidium excavatum*, B = *Quinqueloculina seminula*/*Miliolinella subrotundata*, C = *Elphidium charlottensis*/*Haynesina depressula*, D = *Nonionella flemingi*/*Bolivina pseudoplicata*, E = *Gaudryina convexa*/*Discorbis dimidiatus*, F = *Discorbis dimidiatus*/*Rosalina irregularis*, G = *Gaudryina convexa*/*Bulimina submarginata*, subassociation G<sub>1</sub> = *Quinqueloculina seminula*/*Bulimina submarginata*, G<sub>2</sub> = *Gaudryina convexa*/*Textularia proxispira*, G<sub>3</sub> = *Bulimina submarginata*/*Textularia ensis*, H = *Bulimina submarginata*/*Hanzawaia bertheloti*.



*convexa*, *Textularia proxispira* and *Gavelinopsis lobatulus* (each c. 5-7%). *T. ensis* and *T. proxispira* have their greatest abundances in this subassociation (Figs 34, 38).

**Association H *Bulimina submarginata/Hanzawaia bertheloti***

Stations : 36,40,42,44 = 4

Dominant species association : 7

Depth : 50-68 m

Sediment : muddy fine sand to fine sand

Diversity : Information function H: 2.3-3.3, mean 2.8

This is the deepest water association. It occurs in fine sand at mid shelf depths (>50 m) off the northeast coast of Great Barrier Island. The fauna is dominated by *Bulimina submarginata* (c. 27% mean abundance) with subdominant *Hanzawaia bertheloti* and *Gavelinopsis lobatulus* (each c. 8-9% mean abundance). *Anomalina spherica* is characteristic of this association because of its high fidelity and relative abundance values. All these species occur in their greatest abundances in this association (Figs 34, 39). This association has a lower diversity than nearby associations F and G. It occurs in muddy fine sand at 50 m depth off the Chickens Islands (Hayward *et al.* 1984) and is similar to association D of Hayward (1982a) that occurs in similar fine sediment at 29-41 m depth off the Cavalli Islands. The Cavalli Islands fauna differs however in being codominated by *Cassidulina carinata* and *Globocassidulina canalisuturata*, both of which are rare in these Great Barrier samples.

**Ungrouped sample**

Station : 28

Depth : 19 m

Dominant species association : 4

Sediment : coarse sandy pebble gravel

Diversity : Information function H: 2.8

This station, in an arm of Rangiwhakaea Bay, has a fauna similar to association B, which occurs in similar locations around Port Abercrombie and Rakitu Island. The fauna differs from all others by its unusually high abundance of *Gavelinopsis lobatulus* (c. 29% mean abundance, Fig. 38).

## SPECIES ASSOCIATIONS

The following seven species associations have been selected by inspection from the cluster analysis dendrogram (Fig. 34) generated using all species that occur as 7% or more in any one sample.

**Association 1 (Fig. 36)**

Species : *Ammonia becarrii*, *Elphidium excavatum* s.l.

Dominant sample association : A

Secondary sample association : C

**Association 2 (Fig. 36)**

Species : *Elphidium charlottensis*, *Haynesina depressula*, *Bulimina gibba*, *Notorotalia olsoni*, *Bolivina compacta*

Dominant sample association : C

Secondary sample associations : B,D

**Association 3** (Fig. 37)

Species : *Nonionella flemingi*, *Bolivina pseudoplicata*, *Epistominella vitrea*, *Bolivina striatula*, *Siphouvigerina glabra*

Dominant sample association : D

Secondary sample association : C

**Association 4** (Fig. 37)

Species : *Quinqueloculina seminula*, *Q. suborbicularis*, *Q. parvaggluta*, *Miliolinella subrotundata*, *Gavelinopsis lobatulus*, *Rosalina bradyi*, *Pileolina zelandica*, *Cibicides marlboroughensis*, *Oolina melo*

Dominant sample associations : B,G

Secondary sample association : E,F

**Association 5** (Fig. 38)

Species : *Gaudryina convexa*, *Quinqueloculina colleenae*, *Dyocibicides* sp., *Textularia proxispira*, *T. ensis*

Dominant sample associations : E,G

**Association 6** (Fig. 39)

Species : *Discorbis dimidiatus*, *Rosalina irregularis*, *Bolivina spathulata*, *Elphidium excavatum* n.f.

Dominant sample association : E,F

**Association 7** (Fig. 39)

Species : *Bulimina submarginata*, *Hanzawaia bertheloti*, *Anomalina spherica*

Dominant sample association : H

Secondary sample associations : D,G

**Ungrouped species**

Species : *Miliolinella labiosa*, *Fissurina claricuta*

## SPECIES DIVERSITY

The values for the Information Function, H, for each sample have been mapped and contoured in Fig. 40. This shows that the northeast side of Great Barrier Island has slightly higher overall values for species diversity than the northwest side. The lowest values in this study occur at the heads of the sheltered, slightly brackish bays on the east sides of Ports Fitzroy and Abercrombie (Associations A and I). These values progressively increase moving out into the more open parts of the ports. There is an area in the entrance to Port Fitzroy with a slightly raised level of diversity, possibly produced by increased mixing and transport of tests into this area from outside by strong tidal currents. There are two areas in the northeast study area that have somewhat lowered diversity. These correspond to associations E and H, which have a greater abundance of the one or two dominant species than occurs in nearby associations F and G.

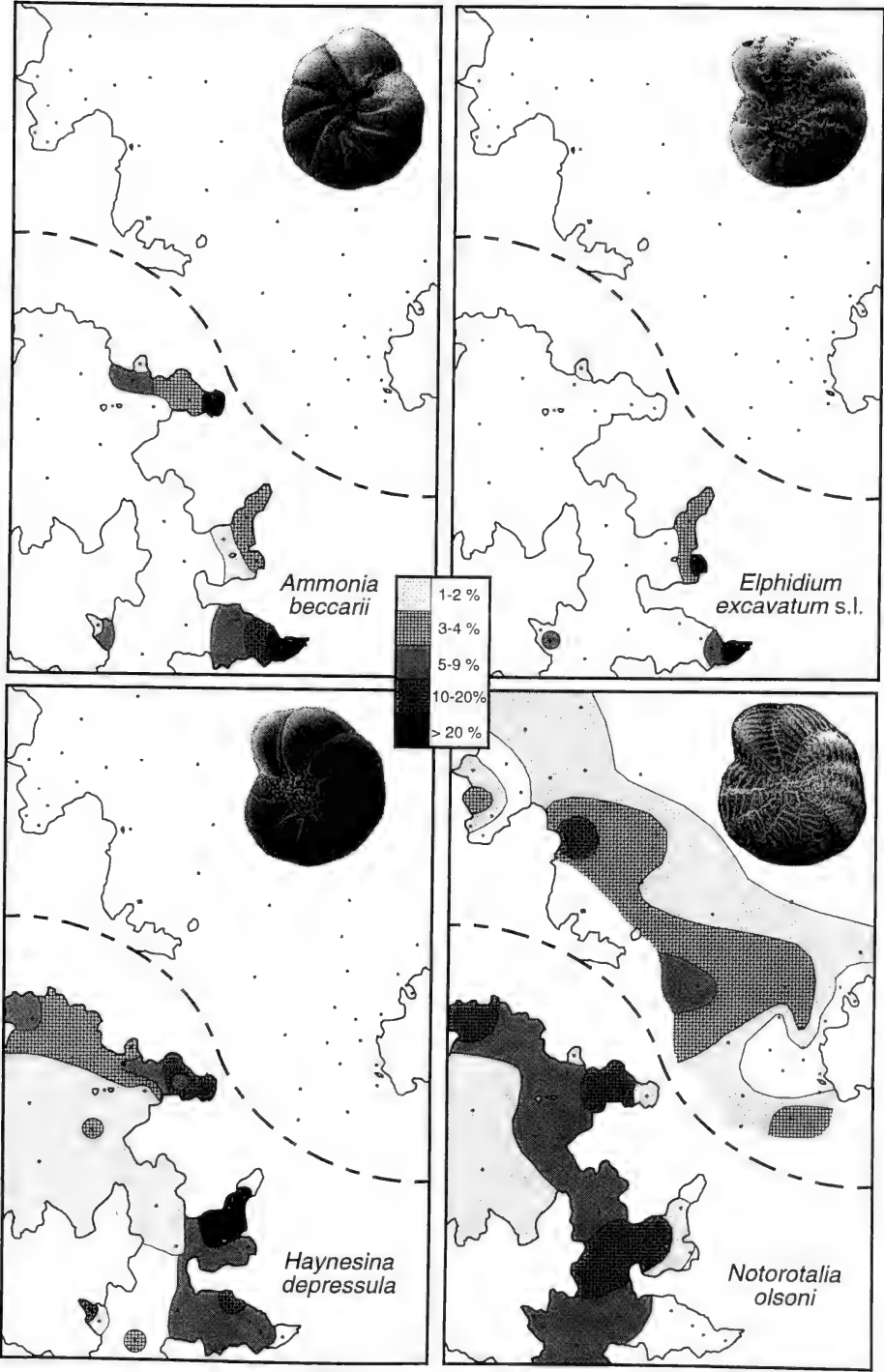


Fig. 36. Contoured abundance distribution maps of the dominant characterising species of species associations 1 and 2 of northern Great Barrier Island.

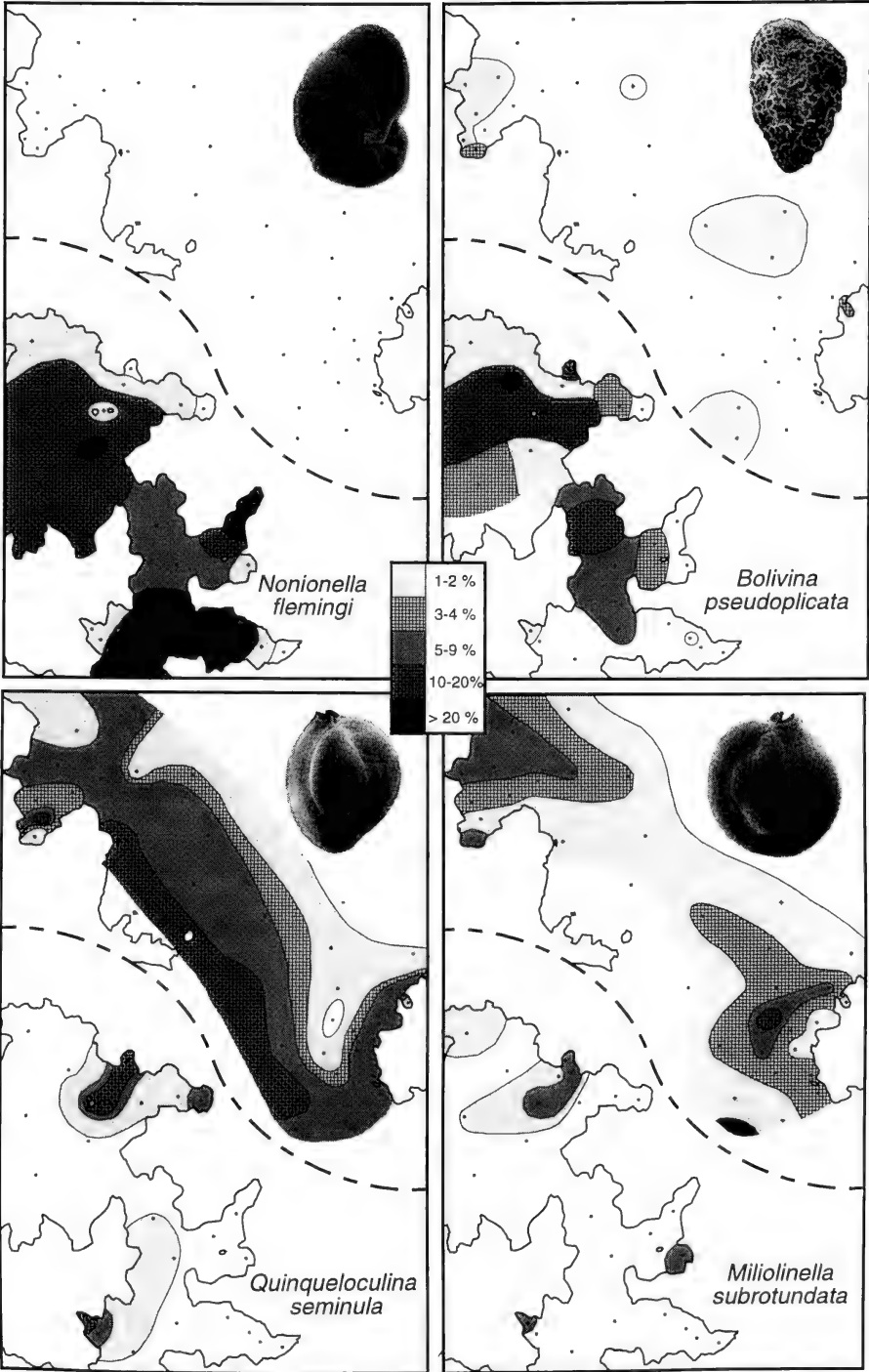


Fig. 37. Contoured abundance distribution maps of the dominant characterising species of species associations 3 and 4 of northern Great Barrier Island.

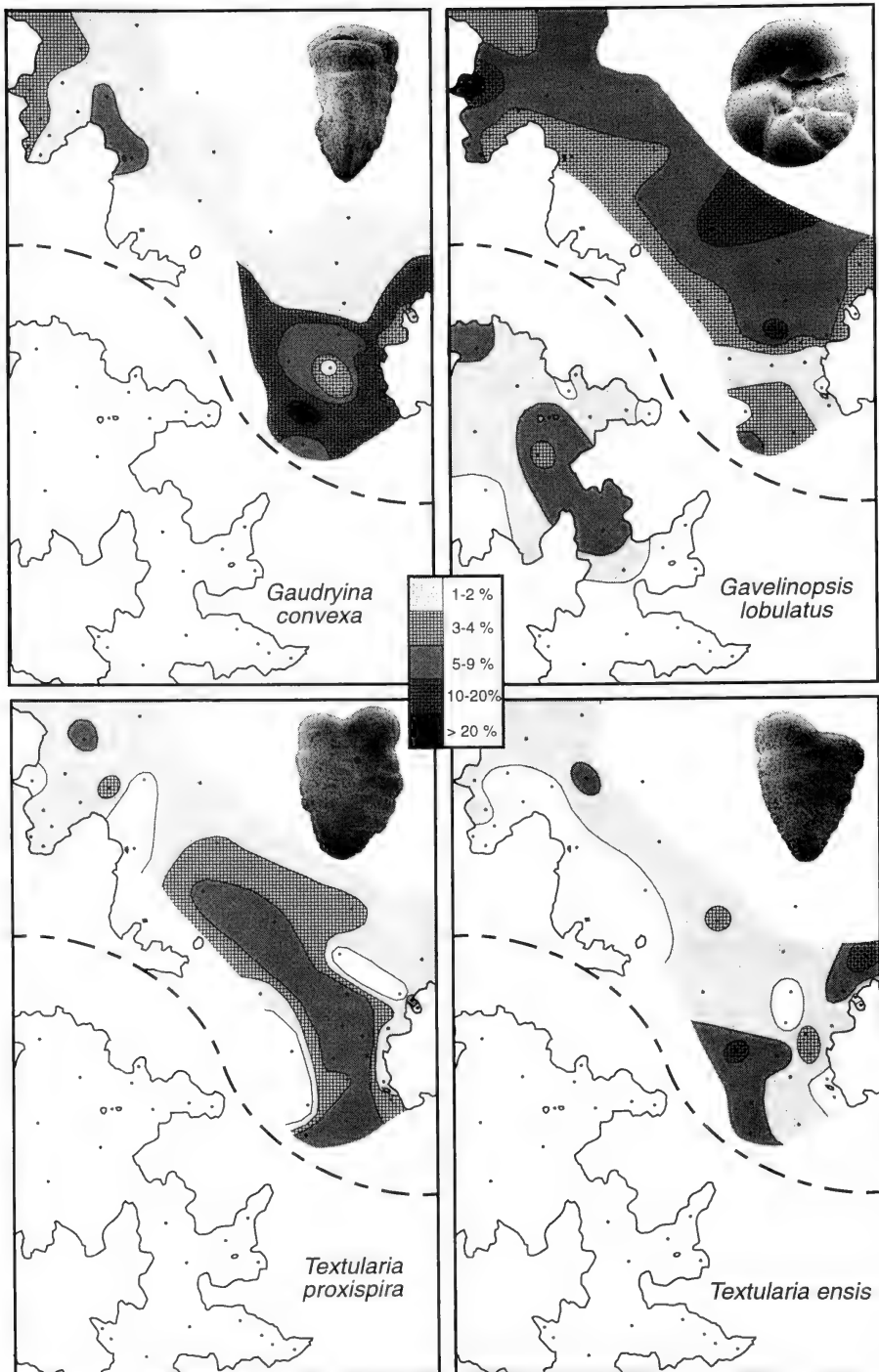


Fig. 38. Contoured abundance distribution maps of the dominant characterising species of species associations 4 and 5 of northern Great Barrier Island.

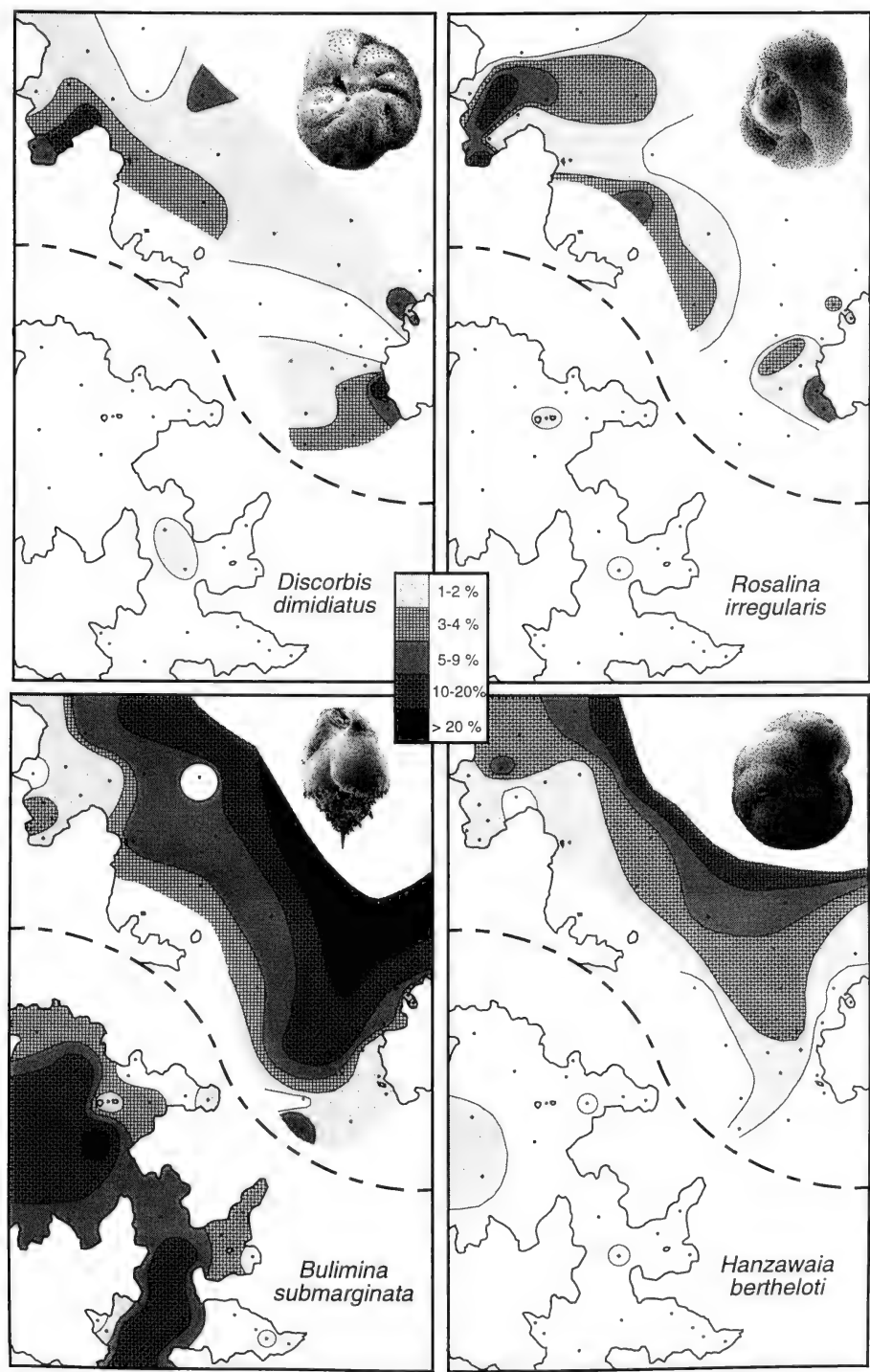


Fig. 39. Contoured abundance distribution maps of the dominant characterising species of species associations 6 and 7 of northern Great Barrier Island.

## ARE THE SAMPLE AND SPECIES ASSOCIATIONS REAL?

There is remarkably close correspondence between the sample and species associations, with a direct one to one relationship between four of the species associations and four of the sample associations. These suggest that associations A and 1, C and 2, D and 3, and H and 7 are strong and robust and reflect real associations of species that inhabit mappably distinct environments.

The boundaries between associations B, E, F, G, 4, 5 and 6 are less clear and overlapping and the recognised associations are less strong. Examination of the individual distribution maps of the dominant species of these associations shows that only *Discorbis dimidiatus* and *Rosalina irregularis* (species association 6) have strongly coinciding distribution patterns and hence the other computer-generated associations are not strong. These associations occur in areas of coarsest sediments and strongest currents and swells, mostly off the northeast side of Great Barrier. Post-mortem transport of tests may be producing some mixing, but it appears that in this environment each of the common species has its own unique environmental requirements and thus its own individual distributional pattern which does not closely overlap with other common species to produce a recognisably recurring association.

We conclude that sample associations A, C, D and H and species associations 1, 2, 3, 6 and 7 are robust and real. The computer-generated grouping of the remaining samples and species into associations is less strong and somewhat forced within the present data set. This does not necessarily mean that usage of these groupings is not useful in helping to understand the ecological distribution patterns.

## ENVIRONMENTAL FACTORS AND THE ASSOCIATIONS

### SALINITY INFLUENCE

The most distinctive sample and species associations are the *Ammonia beccarii*/*Elphidium excavatum* associations (A and 1), as they split off from all others at the highest level of both dendrograms (Fig. 34). This association is characteristic of slightly brackish environments, whereas all other associations in this study are from normal salinity conditions.

### WESTERN AND EASTERN ASSOCIATIONS

At the second highest level the sample dendrogram splits the normal salinity faunas into two groups (associations B, C and D, and associations E, F, G and H) which correspond closely to a split between northwest and northeast Great Barrier distribution. Only association B has samples from both sides of the island. The species dendrogram also splits the normal salinity species associations into northwest (associations 2 and 3) and northeast (associations 4, 5, 6 and 7) groups. In this instance, species association 4, which corresponds to sample association B, is grouped with the northeast group.

This distinct difference between the foraminiferal faunas from either side of northern Great Barrier Island is further illustrated by the distribution patterns of some of the dominant species. *Elphidium excavatum* s.l., *Ammonia beccarii*, *Nonionella flemingi*, *Bolivina striatula* and *Siphouvigerina glabra* occur almost exclusively on the northwest side and *Gaudryina*

*convexa*, *Textularia proxispira*, *T. ensis*, *Rosalina irregularis*, *Discorbis dimidiatus*, *Anomalina spherica* and *Elphidium excavatum* n.f. occur almost exclusively on the northeast side. Only 50% of the total fauna in the quantitative counts occur on both sides of northern Great Barrier. The northeast side has a more diverse fauna (mean  $H = 3.1$ ) with 87% of the taxa (169 species) recorded there, and 63% of the taxa found on the northwest side (mean  $H = 2.8$ ). Other common species found only in the northwest include *Bulimina patagonica*, *Buliminella elegantissima*, and *Massilina* cf. *milletti*; and species only found in the northeast include *Miliolinella labiosa*, *Pyrgo* spp., *Spiroloculina disparilis*, *Triloculina* spp., *Cibicides corticatus*, *Ehrenbergina* spp., *Guttulina* spp., *Oridorsalis umbonatus* and *Siphouvigerina vadeszens*.

The clear distinction between northwest and northeast associations probably relates to basic differences in the overlying water masses. The northeast area is more exposed to the open Pacific Ocean and receives clearer, more oceanic water influenced by the warm, east Northland current. The northwest area is more sheltered and receives more turbid, neritic water influenced by freshwater runoff into Ports Fitzroy and Abercrombie and by the circulating neritic waters of the Hauraki Gulf. The planktic foraminiferal compositional differences also reflect the more neritic character of the water in the west with a low diversity fauna and the greater oceanic influence in the east with greater diversity and size.

#### INFLUENCE OF THE EAST NORTHLAND CURRENT

The influence of the warm, subtropical east Northland current on northeast Great Barrier is manifest in the only known New Zealand occurrence of the tropical *Elphidium crispum*, plus occurrences of warm-water restricted species (Hayward 1980) such as *Elphidium excavatum* n.f., *Buliminoides williamsoniana*, *Textularia fistulosa*, *Cornuspira planorbis*, *Earltheeia clarionensis*, *Pileolina calcarata*, *P. harmeri*, *Nevillina coronata*, *Spiroloculina angulata*, *Carterina spiculotesta*, *Hanzawaia lepida*, *Heronallenia pulvinulinoides*, *Laticarinina coronata*, *Loxostomum limbatum costulatum* and *Rugidia simplex*.

#### INFLUENCE OF OTHER PHYSICAL ENVIRONMENTAL FACTORS

The third order of subdivision in the sample and species dendrograms (Fig. 34) is the level adopted for the recognition of sample and species associations. Within each of the northwest and northeast areas these associations appear to be determined by a combination of physical environmental factors, other than salinity and oceanicity.

The sediment analyses show some apparent correlation between grain size or mud content and some of the faunal associations. Associations D, H, 3 and 7 occur in fine muddy sediment, E occurs in medium sand and B in sandy gravel. The other associations and subassociations exist in an extremely wide range of sediment substrate types. Sediment grain size is in part related to the level of exposure to high wave and current energy. Thus associations D, H, 3 and 7 with the finest sediments also occur in the areas most sheltered from strong wave and current energy. Associations C and 2 are subject to moderate levels of environmental energy, whereas associations B, E, F, G, 4, 5 and 6 are subject to the greatest wave and current activity in the study area.

Sample associations E and F and species association 6 are specialised associations dominated by epifaunal species that attach to rock, pebbles or shells and drop off into the sediment on death. The influence of other factors related to depth on the distribution of the



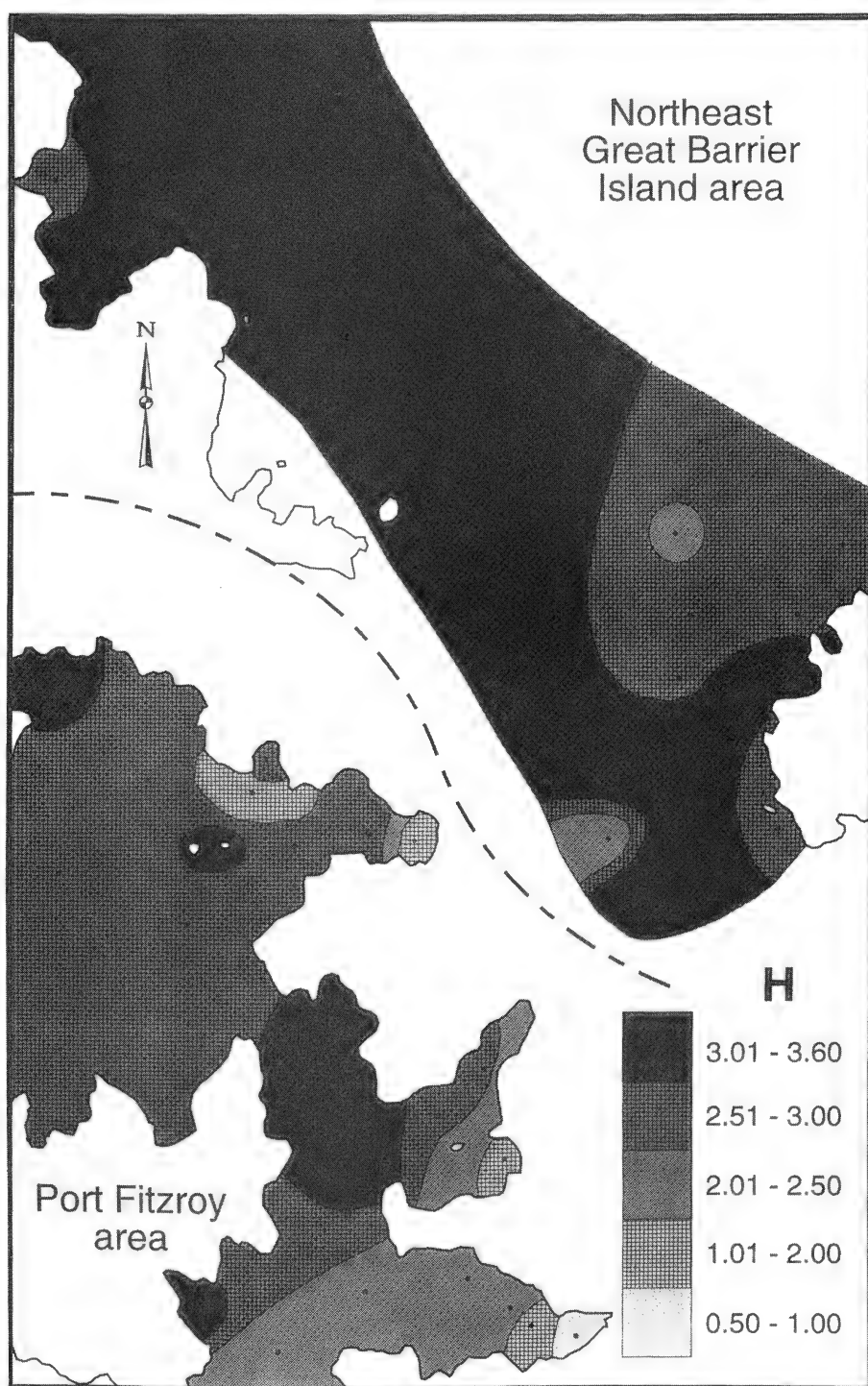


Fig. 40. Contoured map of Information Function,  $H$ , measure of species diversity in the two study areas around northern Great Barrier Island.

different associations is uncertain. There is however, in both the west and east an observable trend from associations inhabiting shallow, near shore habitats to those in quieter, deeper water. The trend in the west is:

A; 1 *Ammonia beccarii*/*Elphidium excavatum* - intertidal to 5 m;

B; 4 *Quinqueloculina seminula*/*Miliolinella subrotundata* - 2-17 m;

C; 2 *Elphidium charlottensis*/*Haynesina depressula* - 4-16 m;

D; 3 *Nonionella flemingi*/*Bolivina pseudoplicata* - 12-35 m.

The trend in the east is:

E,F; 5,6 *Gaudryina convexa*/*Discorbis dimidiatus* and *Discorbis dimidiatus*/  
*Rosalina irregularis* - 1-33 m;

G2; 5 *Gaudryina convexa*/*Textularia proxispira* - 23-51 m;

G1,G3; 5 *Bulimina submarginata*/*Textularia ensis* - 34-58 m;

H; 7 *Bulimina submarginata*/*Hanzawaia bertheloti* - 50-68 m.

## POST-MORTEM TRANSPORT OF FORAMINIFERAL TESTS

The distribution pattern of associations and dominant species indicates that current or wave transport of foraminiferal tests is not a major factor in influencing the foraminiferal sample and species associations around northern Great Barrier Island. The distribution maps of selected common benthic species (Figs 36-39) indicate that there is little post-mortem transport of the dominant characterising species in sample associations A, D and F and species associations 1, 3 and 6, for they have relatively sharp boundaries to their distributions. The dominant characterising species in the other associations have more gradational boundaries to their distribution patterns. These may reflect the actual live distributional range of these species or it may be a result of post-mortem bottom current transport of tests spreading them away from their normal range.

Undoubtedly there is some post-mortem transport and winnowing of tests, especially in areas of strong currents in the entrances to Port Fitzroy and in places exposed to big swells and storms off northeast Great Barrier. For example the abundance of *Hanzawaia bertheloti* and *Bulimina submarginata* tests (characteristic of associations 7 and H) in the shallows of Rangihakaea Bay and as mappable tongues stretching into the shallows west of Rakitu Island (Fig. 39) is best explained by post-mortem inshore transport by northeast swells and currents.

## PLANKTIC FORAMINIFERA (Fig. 41)

### ASSOCIATIONS

Two distinctly different associations of planktic foraminiferal tests occur in sediments on either side of northern Great Barrier Island. On the more exposed northeast side, the planktic association is diverse in size range and taxonomic composition. It is dominated by *Globigerina falconensis* with subdominant *Globigerina quinqueloba* and *Globorotalia inflata*. *Globigerinoides ruber*, *Globigerina bulloides* and *Globigerinita glutinata* are also common. A further 10 species are present in low numbers (Appendix 1). The taxonomic composition, diversity and specimen size show some shoreward movement and input from the plankton of the open oceans off northeast Northland (Hayward 1983).

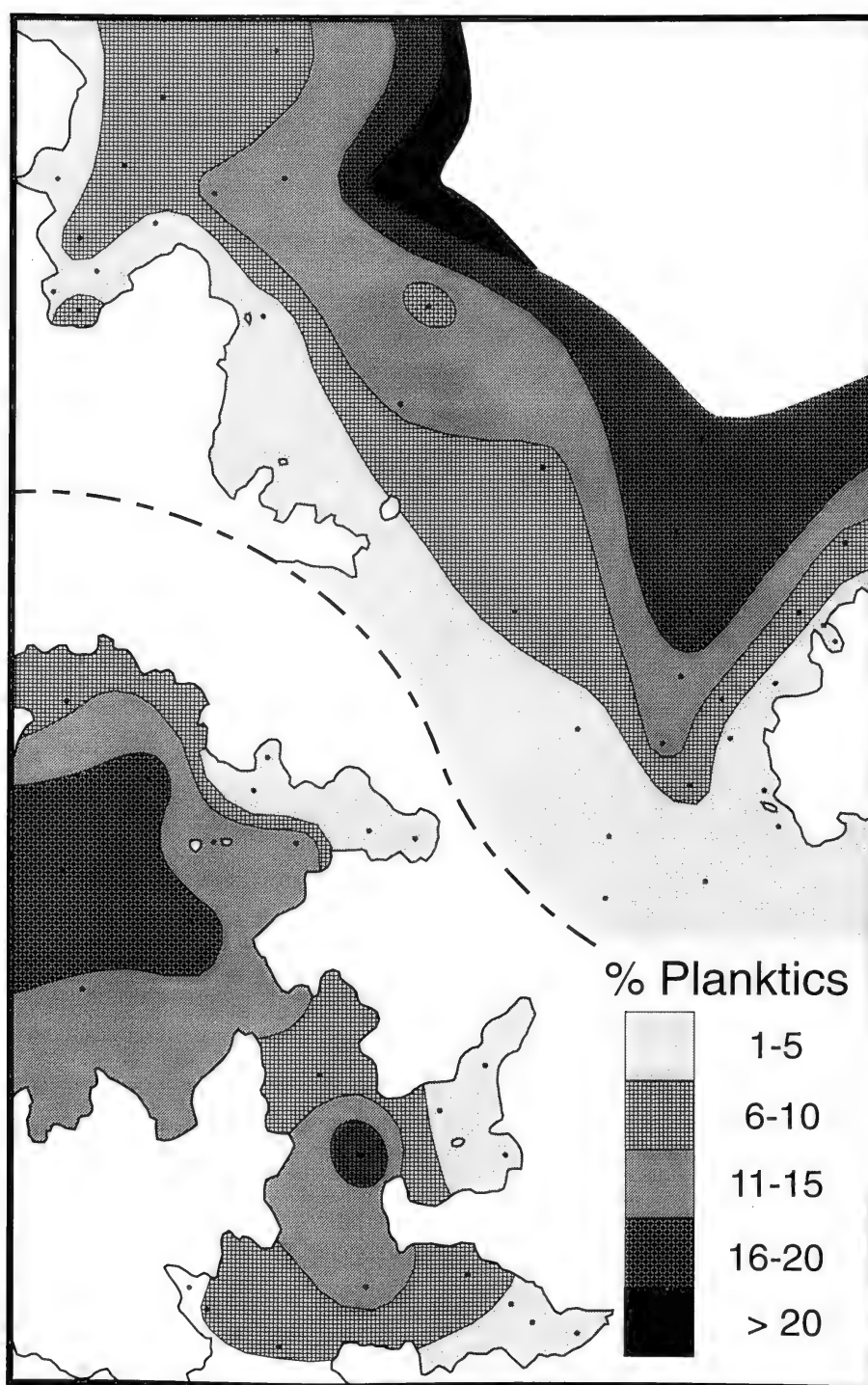


Fig. 41. Contoured map of planktic foraminiferal abundance in the two study areas around northern Great Barrier Island, expressed as a percentage of the total foraminiferal fauna.

The planktic association on the more sheltered northwest side is largely composed of small tests and is of low taxonomic diversity. It is dominated by *Globigerina falconensis* and *Globigerina quinqueloba*, with rare occurrences of only three other species. This composition and small specimen size is typical of nearshore neritic plankton faunas around most of New Zealand (Hayward 1983).

## RELATIVE ABUNDANCE

Background relative abundances of planktic foraminiferal tests seem to be similar on both sides of northern Great Barrier Island, with planktics comprising 15-20% of the foraminiferal fauna in exposed situations on the northwest side (25-40 m depth, Port Abercrombie) and on the northeast side (40-70 m depth). In both areas the relative abundance of planktic tests progressively decreases to 0-5% as one moves into the shallows around the coast and in the bays. The shallow inner extremities of the arms of Ports Abercrombie and Fitzroy, for example, each have 2% or fewer planktics.

The single exception to this usual trend of decreasing planktic abundance with decreasing distance from land, occurs in Port Fitzroy. Here there is a slightly increased abundance of planktic tests (10-16%) within the 25-30 m deep basin of northern Port Fitzroy. This higher than normal relative abundance of planktic tests in an enclosed, sheltered nearshore situation is probably due to concentration of planktic tests carried in to the port by strong tidal currents through Fitzroy Passage. In the quieter waters of northern Port Fitzroy, many small planktic tests settle out of suspension and concentrate in the muddy sediment. A similar explanation is proposed for the even higher values in Port Pegasus, Stewart Island (Hayward *et al.* 1994).

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BRUCE W. HAYWARD and HUGH GRENFELL, Auckland Institute and Museum, Private Bag 92018, Auckland, New Zealand.



APPENDIX 1. Physical characteristics and planktic foraminiferal percentages of Great Barrier foraminiferal samples.

Stat.	Cat. No. <sup>1</sup>	Latitude / Longitude <sup>2</sup>		Depth <sup>3</sup>	%Plank.	H <sup>4</sup>	Sediment
Port Abercrombie/Port Fitzroy							
1	L2803	36° 8.65' S	175° 19.34' E	17	10	3.09	gravelly coarse sand
2	L2807	36° 8.98' S	175° 19.78' E	30	19	2.61	slightly gravelly mud
3	L2809	36° 9.00' S	175° 20.42' E	12	0	1.93	fine-medium sand
4	L2810	36° 8.88' S	175° 20.37' E	2	2	2.91	gravelly fine-medium sand
5	L2811	36° 9.25' S	175° 20.17' E	12	11	3.45	sandy gravel
6	L2812	36° 9.24' S	175° 20.52' E	24	11	2.85	slightly gravelly muddy fine sand
7	L2815	36° 9.18' S	175° 20.93' E	12	3	2.75	slightly gravelly muddy fine sand
8	L2816	36° 9.21' S	175° 21.11' E	2	0	1.41	fine sand
9	L2818	36° 9.60' S	175° 19.40' E	35	18	2.81	slightly gravelly mud
10	L2819	36° 9.81' S	175° 19.50' E	33	14	2.89	slightly gravelly mud
11	L2820	36° 9.60' S	175° 20.03' E	32	20	2.56	slightly gravelly mud
12	L2827	36° 10.12' S	175° 20.70' E	34	9	3.15	slightly gravelly muddy fine sand
13	L2828	36° 10.48' S	175° 20.90' E	29	16	3.09	slightly gravelly muddy fine-medium sand
14	L2830	36° 10.18' S	175° 21.48' E	16	1	2.56	muddy fine sand
15	L2831	36° 9.98' S	175° 21.52' E	4	1	2.52	slightly gravelly muddy fine sand
16	L2832	36° 10.45' S	175° 21.58' E	LT	2	1.97	gravelly coarse sand
17	L2835	36° 10.98' S	175° 20.92' E	22	13	2.49	mud
18	L2837	36° 10.91' S	175° 21.40' E	17	8	2.30	mud
19	L2838	36° 11.02' S	175° 21.62' E	12	5	2.41	mud
20	L2840	36° 11.10' S	175° 21.75' E	5.5	3	1.24	muddy fine sand
21	L2841	36° 11.12' S	175° 21.97' E	MT	0	0.57	slightly gravelly medium-coarse sand
22	L2842	36° 11.02' S	175° 20.05' E	7	0	2.99	slightly gravelly medium-coarse sand
23	L2843	36° 11.08' S	175° 20.19' E	13	7	3.04	medium-fine sand
24	L2844	36° 11.22' S	175° 20.50' E	23	5	2.15	mud
North eastern Great Barrier							
25	F202061	36° 4.1' S	175° 25.8' E	56	8	3.13	slightly gravelly muddy fine sand
26	F202057	36° 4.3' S	175° 25.2' E	34	7	3.35	fine sand
27	F202055	36° 4.6' S	175° 24.9' E	28	8	3.17	fine sand
28	F202049	36° 4.7' S	175° 24.4' E	19	2	2.76	coarse sandy pebbly gravel
29	F202040	36° 4.8' S	175° 25.5' E	33	14	3.46	fine sand
30	F202054	36° 4.9' S	175° 25.2' E	22	3	3.31	fine sand
31	F202048	36° 5.1' S	175° 24.5' E	14	10	3.54	fine sand
32	F202045	36° 5.3' S	175° 24.6' E	9	2	3.26	fine sand
33	F202043	36° 5.5' S	175° 24.3' E	6	7	3.35	gravelly coarse sand
34	F202046	36° 5.6' S	175° 24.6' E	3	4	3.17	fine sand
35	F202041	36° 4.7' S	175° 25.9' E	47	10	3.47	slightly muddy fine sand
36	F202042	36° 4.7' S	175° 26.6' E	59	21	3.28	muddy fine sand
37	F202062	36° 5.5' S	175° 25.8' E	30	4	3.08	gravelly very coarse sand
38	F202060	36° 5.5' S	175° 26.8' E	51	4	3.32	slightly muddy fine sand
39	F202053	36° 6.1' S	175° 26.7' E	35	11	3.35	fine sand
40	F201866	36° 5.7' S	175° 28.2' E	68	19	2.71	muddy fine sand
41	F202052	36° 6.4' S	175° 27.6' E	53	9	3.40	slightly muddy fine sand
42	F201865	36° 6.4' S	175° 28.5' E	60	17	2.26	muddy fine sand
43	F202051	36° 7.2' S	175° 27.5' E	47	7	3.07	slightly gravelly coarse sand
44	F201857	36° 6.9' S	175° 28.4' E	50	16	2.96	fine sand

45	F201880	36° 6.9' S	175° 29.6' E	58	6	2.78	slightly muddy fine sand
46	F201870	36° 7.2' S	175° 29.4' E	51	5	2.91	slightly gravelly coarse sand
47	F201848	36° 7.4' S	175° 29.6' E	5	4	3.17	slightly muddy slightly gravelly very c. sand
48	F201851	36° 7.3' S	175° 29.5' E	9	2	2.79	slightly muddy slightly gravelly coarse sand
49	F201878	36° 7.5' S	175° 29.3' E	23	3	3.31	gravelly coarse sand
50	F201856	36° 7.5' S	175° 28.4' E	44	14	2.71	slightly muddy fine sand
51	F201854	36° 7.6' S	175° 28.8' E	45	9	3.02	slightly muddy gravelly very coarse sand
52	F201875	36° 7.7' S	175° 28.9' E	34	3	3.12	slightly muddy medium sand
53	F201874	36° 7.7' S	175° 28.4' E	36	11	3.03	slightly muddy fine sand
54	F201863	36° 7.8' S	175° 27.7' E	37	2	3.22	slightly gravelly coarse sand
55	F201873	36° 8.2' S	175° 28.6' E	27	7	3.48	fine sand
56	F201850	36° 8.2' S	175° 29.2' E	1	2	2.60	medium sand
57	F201853	36° 8.3' S	175° 29.3' E	12	4	2.78	slightly gravelly medium sand
58	F201860	36° 8.3' S	175° 28.1' E	28	1	2.34	slightly gravelly coarse sand
59	F201872	36° 8.5' S	175° 28.9' E	24	1	3.11	slightly sandy pebbly gravel
60	F201858	36° 8.8' S	175° 28.5' E	25	3	3.39	coarse sandy pebbly gravel

<sup>1</sup> F = Catalogue number of Micropaleontology Section, Institute of Geological and Nuclear Sciences Ltd, Lower Hutt. L = Catalogue number of Marine Departments, Auckland Institute and Museum.

<sup>2</sup> Hydrographic charts NZ 5225 (1:36,000) and NZ 531 (1:100,000).

<sup>3</sup> LT = low tide; MT = mid tide.

<sup>4</sup> H = Information function.

APPENDIX 2. List of foraminifera identified from Great Barrier Island. Asterisked species (\*) were not recorded in the quantitative data, but identified from additional picks of rarer taxa.

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#### BENTHIC SPECIES

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##### Suborder Textulariina

- \**Cribrostomoides jeffreysi* (Williamson); Murray 1971, p. 23, pl. 4.  
*Gaudryina convexa* (Karrer); Hayward 1982a, fig. 6b. This paper fig. 4.  
*Haplophragmoides canariensis* (d'Orbigny); Loeblich & Tappan 1988, pl. 49, figs 12-13.  
*Haplophragmoides wilberti* Andersen; Hayward & Hollis 1994, pl. 2, figs 4-6.  
*Reophax arctica* Brady; Hayward & Hollis 1994, pl. 1, figs 6-10.  
*Reophax moniliforme* Siddall; Hayward & Hollis 1994, pl. 1, figs 11-16.  
*Reophax scorpiurus* Montfort; emend. Bronnimann & Whittaker 1980, p. 260, figs 1-7, 12, 17 (see also Loeblich & Tappan 1988, p. 58, pl. 44, figs 1-3).  
*Rotaliammina adaperata* (Rhumbler); Wells 1985, p. 588, figs 2-3, 10 (as *Trochammina*).  
 \**Rotaliammina* sp.  
 \**Saccammina ?diffflugiformis* (Brady); Hoglund 1947, p. 53, pl. 4, fig. 18 (as *Proteonina*).  
*Sigmoilopsis wanganuiensis* Vella 1957, p. 20, pl. 4, figs 67-70.  
*Sigmoilopsis finlayi* Vella 1957, p. 20, pl. 4, figs 75, 76.  
 \**Sigmoilopsis* sp.  
*Siphonoaperta macbeathi* Vella 1957, p. 19, pl. 4, figs 61, 62, 63.  
 \*?*Siphonaperta* sp.  
*Siphonotextularia blacki* Vella 1957, p. 16, pl. 4, figs 53-54.  
*Siphonotextularia mestayerae* Vella 1957, p. 17, pl. 4, figs 55-57.  
 \**Spiroplectammina* cf. *biformis* (Parker & Jones); Loeblich & Tappan 1988, pl. 119, figs 19-20.  
*Technitella* sp.  
*Textularia* cf. *conica* d'Orbigny; Barker 1960, pl. 43, figs 13-14.  
*Textularia earlandi* (Parker); Hayward & Hollis 1994, pl. 3, figs 1-4.  
*Textularia ensis* Vella 1957, p. 16, pl. 3, figs 46-47. Hayward 1982a, fig. 6p. This paper fig. 5.  
*Textularia fistulosa* Brady; Hayward & Grace 1981, fig. 5a.  
*Textularia proxispira* Vella 1957, p. 15, pl. 3, figs 48, 52. This paper fig. 6.  
*Textularia* sp.  
*Trochammina bartrami* Hedley *et al.* 1967, p. 21, pl. 6, figs 2a-c, text-figs 9-10.  
*Trochammina inflata* (Montagu); Hayward & Hollis 1994, pl. 2, figs 10-11.  
*Trochammina sorosa* Parr 1950, p. 16, pl. 3, figs 46-47.  
*Trochammina* sp.

##### Suborder Miliolina

- Cyclogyra involvens* (Reuss); Hedley *et al.* 1967, p. 24, text-fig. 16.  
*Massilina* cf. *millettii* (Wiesner); Barker 1960, pl. 9, figs 9-10.  
*Miliolinella labiosa* (d'Orbigny); Hedley *et al.* 1967, p. 29, pl. 8, figs 2a-c.  
*Miliolinella subrotundata* (Montagu); Hayward *et al.* 1994, fig. 3E. This paper fig. 7.  
 \**Nevillina coronata* (Millett); Brook *et al.* 1981, fig. 5a.  
*Pyrgo anomala* (Schlumberger); Vella 1957, p. 29, pl. 7, figs 135-136 (as *Biloculina*).  
*Pyrgo comata* (Brady); Barker 1960, pl. 3, fig. 9.  
*Pyrgo depressa* (d'Orbigny); Vella 1957, p. 29, pl. 7, figs 137, 140.  
*Pyrgo* aff. *ezo* Asano; Vella 1957, p. 29, pl. 7, figs 138-139.  
*Quinqueloculina agglutinans* d'Orbigny; Hedley *et al.* 1965, p. 12, pl. 2, figs 7a-b.  
*Quinqueloculina ?ariminensis* d'Orbigny; Hayward 1982a, fig. 6k.  
*Quinqueloculina auberiana* d'Orbigny; Hedley *et al.* 1967, p. 25, pl. 8, figs 5a-c.  
*Quinqueloculina bicornis* (Walker & Jacob); Murray 1971, p. 57, pl. 20, figs 1-5.  
*Quinqueloculina colleenae* Vella 1957, p. 25, pl. 5, figs 86, 93. This paper fig. 8.

- Quinqueloculina delicatula* Vella 1957, p. 26, pl. 4, figs 77-79.
- Quinqueloculina* aff. *lata* Terquem; Murray 1971, pl. 23, figs 1-3.
- Quinqueloculina neosigmoilinoidea* Kennett; Vella 1957, p. 24, pl. 6, figs 115-117 (as *Q. sigmoilinoidea*).
- Quinqueloculina parvagguta* Vella 1957, pl. 4, figs 71-73.
- Quinqueloculina patagonica* (d'Orbigny); Hedley *et al.* 1967, pl. 8, fig. 6.
- Quinqueloculina seminula* (Linnaeus); Hedley *et al.* 1965, p. 13, pl. 2, figs 8a-b. This paper fig. 9.
- Quinqueloculina* cf. *semistriata* d'Orbigny; McCulloch 1977, p. 507, pl. 219, figs 19-20.
- Quinqueloculina suborbicularis* d'Orbigny; Vella 1957, p. 23, pl. 6, figs 102-104. Hayward 1982a, fig. 6a.
- Quinqueloculina tenagos* Parker; Hedley *et al.* 1965, p. 27, pl. 9, figs 1A-C.
- \**Spiroloculina communis* Cushman & Todd; Hedley *et al.* 1965, p. 13, pl. 2, figs 9a-c.
- Spiroloculina disparilis* Terquem; Vella 1957, p. 27, pl. 6, figs 122-123.
- \**Spiroloculina angulata* Cushman; Hayward 1980, fig. 2.
- \**Spirosigmoilina tenuis* (Czjzek); Barker 1960, pl. 10, figs 7, 8, 11 (as *Sigmoilina*)
- Triloculina chrysostoma* (Chapman); Vella 1957, p. 28, pl. 5, figs 97-99.
- Triloculina tricarinata* d'Orbigny; Barker 1960, pl. 3, fig. 17.
- Triloculina trigonula* (Lamarck); Boltovskoy *et al.* 1980, p. 52, pl. 33, figs 14-16.
- Suborder Rotalliina
- Acervulina inhaerens* Schulze; Hedley *et al.* 1967, pl. 1, fig. 2.
- Ammonia beccarii* (Linnaeus); Hayward 1979, fig. 3a. This paper figs 2-13.
- Amphicoryna* cf. *nebulosa* (Ishizaki); Hayward & Buzas 1979, pl. 4, fig. 46.
- Amphicoryna proxima* (Silvestri); Barker 1960, pl. 64, fig. 15.
- Amphicoryna scalaris* (Batsch); Barker 1960, pl. 58, figs 28-31.
- Anomalina spherica* Finlay; Hayward *et al.* 1994, figs 3L-N. This paper fig. 14.
- Astaculus neolatus* Vella 1957, pl. 7, figs 143, 146-148.
- Bolivina* cf. *arta* MacFadyen; Hornibrook 1961, pl. 10, fig. 184 (as *B. lapsus*, see Hayward & Buzas 1979).
- Bolivina compacta* Sidebottom; Hedley *et al.* 1967, p. 30, pl. 9, fig. 3.
- Bolivina pseudoplicata* Heron-Allen & Earland; Hedley *et al.* 1967, pl. 9, fig. 4. This paper fig. 10.
- Bolivina robusta* Brady; Barker 1960, pl. 53, figs 7-9.
- Bolvina* cf. *seminuda* Cushman; Parr 1950, pl. 12, fig. 17.
- Bolivina spathulata* (Williamson); Hedley *et al.* 1965, p. 21, pl. 6, fig. 23.
- Bolivina* cf. *spinescens* Cushman 1911, p. 47, fig. 7b.
- Bolivina striatula* Cushman; Boltovskoy *et al.* 1980, p. 18, pl. 3, figs 9-13. This paper fig. 11.
- Bolivina subexcavata* Cushman & Wickenden; Hayward & Grace 1981, p. 49, fig. 5c.
- Bolivina* cf. *translucens* Phleger & Parker; Boltovskoy *et al.* 1980, pl. 3, figs 18-21.
- Bolivina* sp.
- Bulimina elongata* d'Orbigny; Barker 1960, pl. 51, figs 1, 2.
- Bulimina gibba* Fornasini; Barker 1960, pl. 50, figs 1-4. This paper fig. 15.
- Bulimina patagonica* d'Orbigny; Boltovskoy *et al.* 1980, pl. 5, figs 13-17.
- Bulimina submarginata* Parr; Hayward 1982a, fig. 6m. This paper fig. 16.
- Buliminella elegantissima* (d'Orbigny); Loeblich & Tappan 1988, pl. 572.
- Buliminoides madagascarensis* (d'Orbigny); Hayward 1982a, fig. 6i.
- Buliminoides williamsonianus* (Brady); Hayward 1982a, fig. 6j.
- Cancris oblongus* (Williamson); Haynes 1973, pp. 145-147, text figs 27, nos 1-3, pl. 20, fig. 13.
- \**Carterina spiculotesta* (Carter); Hayward 1980, figs 6-7.
- Cassidulina carinata* Silvestri; Eade 1967, p. 429, fig. 2, nos. 5-9. Hayward 1982a, fig. 6k.
- \**Chilostomella ovoidea* Reuss; Loeblich & Tappan 1988; p. 625, pl. 701.
- Cibicides corticatus* Earland; Vella 1957, pl. 9, figs 195-197.
- Cibicides* cf. *deliquatus* Finlay; Hornibrook *et al.* 1989, p. 89, fig. 23, nos. 18a, b.
- Cibicides marlboroughensis* Vella 1957, p. 40, pl. 9, figs 189-191.

*Cornuspira* sp.

*Cymbaloporeta bradyi* (Cushman); Barker 1960, pl. 102, fig. 14.

\**Dentalina subemaciata* Parr 1950, p. 329, pl. 7, fig. 1.

\**Dentalina mutsui* Hada; Albani 1968, p. 23, fig. 78.

\**Dentalina translucens* Parr 1950, p. 328, pl. 11, fig. 25.

*Discorbinella vitrevoluta* (Hornibrook); Brook *et al.* 1981, fig. 5b.

*Discorbis dimidiatus* (Jones & Parker); Hedley *et al.* 1967, p. 33-36, pl. 1, fig. 4, pl. 10, figs 1-3, text-figs 28-43. This paper figs 17-18.

*Dyocibicides* sp. Vella 1957, p. 41, pl. 9, figs 198-200.

*Earltheeia clarionensis* McCulloch; Brook *et al.* 1981, fig. 5c.

*Ehrenbergina aspinosa* Parr; Eade 1967, fig. 7, nos 4-6, fig. 8, nos 1,2.

*Ehrenbergina mestayeri* Cushman; Eade 1967, fig. 8, nos 6,7.

*Elphidium advenum* f. *depressulum* Cushman; Hayward *et al.* 1994, fig. 3O.

*Elphidium charlottensis* (Vella) 1957, p. 38, pl. 9, figs 187, 188 (as *Elphidiononion*). This paper fig. 20.

*Elphidium crispum* (Linnaeus); Loeblich & Tappan 1988, p. 674, pls 786, 787.

*Elphidium excavatum* s.l. Cushman; Hayward & Hollis 1994, pl. 5, figs 6-8. This paper fig. 19.

*Elphidium excavatum* n.f. Hayward 1982a, fig. 5b (as *Elphidium oceanicum*).

*Elphidium novozealandicum* Cushman; Hayward *et al.* 1994, fig. 3P.

*Epistominella vitrea* Parker; Todd & Low 1981, p. 40 (in key), 3 figs. This paper figs 21-22.

*Evolvocassidulina orientalis* (Cushman); Hayward 1982a, fig. 6u.

*Fissurina baccata* (Heron-Allen & Earland 1922), p. 162, pl. 6, figs 15,16 (as *Lagena orbignyana* var. *baccata*).

*Fissurina biumbonata* McCulloch; Hayward & Grace 1981, p. 50, fig. 5d.

*Fissurina claricurta* McCulloch 1977, p. 95, pl. 58, fig. 16. Brook *et al.* 1981, fig. 5d.

*Fissurina clathrata* (Brady); Barker 1960, pl. 60, fig. 4.

*Fissurina contusa* Parr; Barker 1960, pl. 60, fig. 3. Brook *et al.* 1981, fig. 5e.

*Fissurina contusa colomboensis* McCulloch 1977, p. 97, pl. 64, fig. 5.

*Fissurina* cf. *elliptica* Seguenza; Boltovskoy *et al.* 1980, p. 32, pl. 15, figs 11-13.

*Fissurina laevigata* Reuss; Barker 1960, pl. 114, fig. 8.

*Fissurina lucida* (Williamson); Albani & Yassini 1989, p. 397, fig. 4E.

*Fissurina* cf. *marginata* (Montagu); Hayward & Buzas 1979, p. 57, pl. 16, fig. 207.

*Fissurina marginatoperforata* (Seguenza); Albani & Yassini 1989, p. 398, figs 6F-G.

\**Fissurina orbignyana* Seguenza; Hayward & Buzas 1979, p. 57, pl. 16, fig. 210.

\**Fissurina quadrirevertens* McCulloch; Brook *et al.* 1981, fig. 5f.

*Fissurina semialata* (Balkwill & Millett); Brook *et al.* 1981, fig. 5g.

*Fissurina subovata* (Parr); Parr 1950, pl. 10, figs 12-14.

*Fursenkoina schreibersiana* (Czjzek); Hayward & Buzas, 1979, p. 58, pl. 17, fig. 212.

*Fursenkoina* sp.

*Gavelinopsis hamatus* Vella 1957, p. 35, pl. 9, figs 177-180. Hayward 1982a, fig. 6t.

*Gavelinopsis lobatulus* (Parr); Hayward *et al.* 1994, fig. 4A. This paper fig. 23.

*Glaboratella margaritaceus* (Earland); Earland 1933, p. 125, pl. 4, figs 23-25 (as *Discorbis*).

\**Globobulimina notovata* (Chapman); Barker 1960, pl. 50, fig. 13.

*Globocassidulina canalisuturata* Eade; Hayward 1982a, fig. 6n.

*Globocassidulina minuta* (Cushman); Eade 1967, fig. 5.2-3.

*Globulina inaequalis* Reuss; McCulloch 1977, p.182, pl.77, figs 4-5.

*Guttulina bartschi* Cushman & Ozawa 1930, pl.1, fig.10.

*Guttulina irregularis* (d'Orbigny); Cushman & Ozawa 1930, p. 25, pl. 3, figs 3, 4.

*Guttulina yabei* Cushman & Ozawa 1929, p. 68, pl. 13, fig. 2, pl. 14, fig. 6.

*Gypsina vesicularis* (Parker & Jones); Barker 1960, pl. 101, figs 9-12.

*Gyroidina* sp.

*Hanzawaia bertheloti* (d'Orbigny); Hayward 1982a, fig. 6q-r. This paper fig. 24.

- Hanzawaia complanata* (Sidebottom); Hornibrook 1961, pl. 27, fig. 532 (as *Discorbinella*).  
 \**Hanzawaia lepida* (Hornibrook 1961), p. 117, pl. 15, figs 306, 307, 317 (as *Discorbinella*).  
*Hanzawaia* sp.  
*Haynesina depressula* (Walker & Jacob); Hayward & Hollis 1994, pl. 5, figs 13-16. This paper fig. 25.  
 \**Heronallenia pulvinulinoides* (Cushman) 1915, pl. 6, fig. 3 (as *Discorbinella*).  
 \**Hoeglundina elegans* (d'Orbigny); Loeblich & Tappan 1988, pl. 478, figs 1-5.  
*Laevidentalina communis* (d'Orbigny); Barker 1960, pl. 62, figs 21, 22 (as *Dentalina*).  
*Laevidentalina filiformis* (d'Orbigny); Hornibrook 1961, pl. 6, fig. 92 (as *Rotalia*).  
*Lagena* cf. *alticostatiformis* McCulloch 1977, p. 26, pl. 53, figs 5, 6.  
 \**Lagena crenata* Parker & Jones; Barker 1960, pl. 57, figs 15, 21.  
 \**Lagena doveyensis* (Haynes); Albani & Yassini 1989, figs 2H-I.  
 \**Lagena flatulenta* Loeblich & Tappan; Albani 1968, p. 24, fig. 86.  
*Lagena* cf. *hispida* Reuss; Barker 1960, pl. 57, fig. 2.  
*Lagena lyelli* (Seguenza); Boltovskoy *et al.* 1980, pl. 20, figs 15-17 (as *Lagena sulcata* var. *lyellii*).  
 \**Lagena* cf. *mccullochi* Albani & Yassini 1989, figs 2O-P.  
 \**Lagena nebulosa* Cushman; Barker 1960 pl. 56, fig. 12.  
*Lagena spiratiformis* McCulloch; Albani & Yassini 1989, figs 2V-W.  
*Lagena sulcata spicata* Cushman & McCulloch; Barker 1960, pl. 58, figs 4-6.  
*Lagena* cf. *striata strumosa* Albani & Yassini 1989, fig. 2U  
 \**Lagenosolenia sigmoidella timmsensis* (Cushman & Gray). McCulloch 1977, p. 72, pl. 51, figs 10-14.  
 \**Lagenosolenia tubulifera* (Egger).  
*Lagenosolenia* sp.  
 \**Laticarinina coronata* (Heron-Allen & Earland); Hornibrook 1961, pl. 15, figs 310, 311, 318.  
 \**Lenticulina asterizans* Parr 1950, p. 322, pl. 11, figs 9-10.  
*Lenticulina australis* Parr 1950, p. 322, pl. 11, figs 7, 8.  
 \**Lenticulina tota* (Cushman); Cushman 1923, p. 111, pl. 29, fig. 2, pl. 30, fig. 1 (as *Robulus*).  
*Loxostomum karrerianum* (Brady); Hornibrook 1968, p. 77, fig. 14.  
 \**Loxostomum limbatum costulatum* (Cushman); Hayward 1980, fig. 3.  
 \**Mychostomina revertens* (Rhumbler); Brook *et al.* 1981, fig. 5i.  
*Mychostomina* sp.  
*Neoconorbina pacifica* Hofker; Hayward 1982a, fig 6g-h.  
 \**Neoconorbina* n.sp.  
*Nodosaria* sp.  
*Nonion* sp.  
*Nonionella flemingi* (Vella); Hayward *et al.* 1994, fig. 4C. This paper fig. 26.  
 \**Nonionella magnalingua* Finlay; Hornibrook 1961, pl. 12, figs 226, 232-233.  
*Nonionella turgida* (Williamson); Barker 1960, pl. 109, figs 17-19.  
*Notorotalia depressa* Vella 1957, p. 47, pl. 1, figs 13, 19, 20. Hayward 1982a, fig. 5x.  
*Notorotalia olsoni* Vella 1957, p. 50, pl. 2, figs 23-24. Hayward 1982a, fig. 5u-v. This paper fig. 27-28.  
*Oolina globosa* (Montagu); Hayward & Buzas 1979, p. 68, pl. 23, figs 284-285.  
*Oolina hexagona* (Williamson); Hayward & Buzas 1979, p. 68, pl. 23, fig. 286.  
 \**Oolina lineata* (Williamson); Barker 1960, pl. 57, fig. 13.  
*Oolina melo* d'Orbigny; Barker 1960, pl. 58, figs 28-31.  
*Oolina scalariformis* McCulloch 1977, p. 84, pl. 54, fig. 20.  
*Oolina tasmanica* Parr 1950, p. 303, pl. 8, fig. 4.  
*Oridorsalis umbonatus* (Reuss); Hayward & Buzas 1979, p. 68, pl. 24, figs 295-296.  
*Palliolatella* cf. *aradisiformis* Albani & Yassini 1989, fig. 5F.  
*Palliolatella lacunata paucialveolata* Albani & Yassini 1989, figs 5L-M.  
*Palliolatella* sp.  
*Patellina corrugata* Williamson; Hornibrook 1961, p. 97, pl. 13, fig. 250.  
*Patellinella inconspicua* (Brady); Hayward 1982a, fig. 5q.  
*Pileolina calcarata* (Heron-Allen & Earland); Hayward 1982a, fig. 5j-k.

- Pileolina harmeri* (Heron-Allen & Earland); Hayward 1982a, fig. 6e-f.  
*Pileolina patelliformis* (Brady); Hayward 1982a, fig. 5n-o.  
*Pileolina radiata* Vella 1957, p. 36, pl. 8, figs 170, 171. Hayward 1982a, figs 5h-i.  
*Pileolina zealandica* Vella; Hayward 1982a, fig. 5l-m.  
*Planodiscorbis rarescens* (Brady); Barker 1960, pl. 90, figs 2-3.  
*Planoglabratella opercularis* (d'Orbigny); Hayward 1982a, fig. 6c-d.  
*Planorbulina acervalis* Brady; Barker 1960, pl. 92, fig. 4.  
*Planulinoides planoconcava* (Chapman, Parr & Collins); Parr 1932, pl. 22, figs 34a-c (as *Planulina biconcava* var. *planoconcava*).  
 \**Procerolagena crassimPLICATA* Albani & Yassini 1989, fig. 3A.  
*Procerolagena cylindrocostata* Albani & Yassini 1989, fig. 3D.  
 \**Procerolagena distoma margaritifera* (Parker & Jones); Albani & Yassini 1989, figs 3B-C.  
 \**Procerolagena elongata* (Ehrenberg); Albani & Yassini 1989, fig. 3H.  
*Procerolagena* sp.  
*Rectobolivina collumellaris* (Brady); Barker 1960, pl. 75, figs 15-17.  
*Rosalina bradyi* (Cushman); Hayward 1982a, fig. 5y. This paper fig. 29-30.  
*Rosalina irregularis* (Rhumbler); Hedley *et al.* 1967, pl. 11, fig. 3. Hayward 1982a, fig. 6s. This paper fig. 31.  
*Rosalina paupereques* Vella 1957, p. 35, pl. 9, figs 181-182.  
 \**Rugidia simplex* Collins; Hayward & Grace 1981, p. 50, fig. 5g.  
 \**Saracenaria latifrons* (Brady); Barker 1960, pl. 113, fig. 11.  
*Sigmavirgulina tortuosa* (Brady); Hayward 1980, fig. 5.  
*Sigmoidella elegantissima* (Parker & Jones); Barker 1960, pl. 72, fig. 12.  
 \**Sigmoidella kagaensis* Cushman & Ozawa; Loeblich & Tappan 1988, pl. 49, figs 3-7.  
*Sigmomorphina lacrimosa* Vella 1957, p. 31, pl. 8, figs 149-151.  
*Siphouvigerina glabra* Millett; Hayward & Triggs 1994, fig. 4, no. 3. This paper fig. 32.  
*Siphouvigerina interrupta* (Brady); Barker 1960, pl. 75, figs 12-14 (as *Neouvigerina*).  
*Siphouvigerina vadeszens* (Cushman); Vella 1963, pl. 2, fig. 17.  
*Sphaeroidina bulloides* d'Orbigny; Barker 1960, pl. 84, figs 1-7.  
 \**Spirillina denticulina* Brady; Barker 1960, pl. 85, fig. 17.  
*Spirillina vivipara* Ehrenberg; Barker 1960, pl. 85, figs 1-4.  
 \**Spirillina* sp.  
*Svartkina australiensis* (Chapman, Parr & Collins); Brook *et al.* 1981, fig. 5j.  
 \**Trifarina carinata bradyana* (Cushman) 1932, p. 45, pl. 6, figs 9-10.  
*Trifarina* n.sp.  
 \**Uvigerina peregrina* Cushman; Barker 1960, pl. 74, figs 11, 12.  
 \**Vaginulina vertebralis* Parr 1932, p. 221, pl. 22, fig. 42.  
*Virgulopsis turris* (Heron-Allen & Earland); Hayward 1982a, fig. 5c.  
*Zeafiorilus parri* (Cushman); Hayward & Triggs 1994, fig. 4, nos. 16-17.

#### PLANKTIC SPECIES

- Globigerina bulloides* d'Orbigny; Hayward 1983, p. 64, figs 2C-E.  
*Globigerina falconensis* Blow; Hayward 1983, p. 64, figs 2I-K.  
*Globigerina quinqueloba* Natland; Hayward 1983, p. 64, figs 2O-Q.  
*Globigerinella aequilateralis* (Brady); Hayward 1983, p. 49, figs 3A-C.  
*Globigerinita glutinata* (Egger); Hayward 1983, p. 70, figs 3F-H.  
*Globigerinoides ruber* (d'Orbigny); Hayward 1983, p. 70, figs 3N-O.  
 \**Globigerinoides sacculifer* (Brady); Hayward 1983, p. 70, figs 3P-R.  
*Globorotalia crassula* Cushman & Stewart; Hayward 1983, p. 70, figs 4D-F.  
*Globorotalia hirsuta* (d'Orbigny); Hayward 1983, p. 70, figs 4G-I.  
*Globorotalia inflata* (d'Orbigny); Hayward 1983, p. 70, figs 4J-L.

*Globorotalia scitula* (Brady); Hayward 1983, p. 70, figs 4M-O.

*Globorotalia truncatulinoides* (d'Orbigny); Hayward 1983, p. 71, figs 4P-R.

*Neogloboquadrina dutertrei* (d'Orbigny); Hayward 1983, p. 71, figs 5D-F.

*Neogloboquadrina pachyderma* (Ehrenberg); Hayward 1983, p. 71, figs 5G-I.

\**Orbulina universa* d'Orbigny; Hayward 1983, p. 70, fig 5J.

*Pulleniatina obliquiloculata* (Parker & Jones); Hayward 1983, p. 71, figs 5K-M.

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APPENDIX 3. Main characterising species of the eight benthic foraminiferal associations recognised around northern Great Barrier Island. Species are arranged in order of decreasing Association Scores (Ass.Sc.) calculated from each species abundance (Abund.), fidelity (Fid.), persistence (Pers.), dominance (Dom.) and relative abundance (Rel.) within each association (see text for explanation).

	Dom.	Pers.	Fid.	Abund.	Rel.	Ass.Sc.
ASSOCIATION A <i>Ammonia beccarii</i> / <i>Elphidium excavatum</i>						
Stns. 8,16,20,21 = 4						
<i>Ammonia beccarii</i>	10.0	1.00	0.82	62.3	57.0	68.2
<i>Elphidium excavatum</i> s.l.	6.6	0.75	0.68	15.0	13.8	27.4
<i>Haynesina depressula</i>	6.4	0.75	0.02	7.3	3.8	15.2
ASSOCIATION B <i>Quinqueloculina seminula</i> / <i>Miliolinella subrotundata</i>						
Stns. 1,4,5,47 = 4						
<i>Quinqueloculina seminula</i>	8.0	1.00	0.25	9.5	4.9	21.4
<i>Miliolinella subrotundata</i>	7.3	1.00	0.33	7.8	4.8	20.4
<i>Elphidium charlottensis</i>	5.8	1.00	0.25	9.3	3.9	18.0
<i>Bolivina pseudoplicata</i>	4.3	1.00	0.55	6.3	4.0	17.6
<i>Pileolina zelandica</i>	4.5	1.00	0.50	4.8	3.2	16.6
<i>Haynesina depressulus</i>	5.0	1.00	0.29	5.0	1.5	15.0
<i>Oolina melo</i>	3.0	0.75	0.25	3.5	2.3	10.9
<i>Rosalina bradyi</i>	3.5	0.75	0.20	3.3	1.9	10.8
<i>Gavelinopsis lobatulus</i>	4.0	0.75	0.07	4.3	0.4	10.4
<i>Notorotalia olsoni</i>	4.0	0.75	0.02	4.5	1.1	10.3
ASSOCIATION C <i>Elphidium charlottensis</i> / <i>Haynesina depressula</i>						
Stns. 3,7,14,15,22,23 = 6						
<i>Elphidium charlottensis</i>	8.2	1.00	0.26	17.8	12.4	27.8
<i>Haynesina depressula</i>	7.7	1.00	0.30	16.2	12.7	26.8
<i>Ammonia beccarii</i>	5.5	1.00	0.85	7.7	2.2	21.5
<i>Notorotalia olsoni</i>	6.7	1.00	0.30	9.7	6.3	20.7
<i>Bulimina gibba</i>	3.0	0.83	0.61	3.3	2.5	14.0
<i>Bolivina compacta</i>	3.3	0.67	0.19	3.7	2.5	10.6
<i>Quinqueloculina seminula</i>	4.0	0.67	-0.03	4.8	0.2	9.4
ASSOCIATION D <i>Nonionella flemingi</i> / <i>Bolivina pseudoplicata</i>						
Stns. 2,6,9,10,11,12,13,17,18,19,24 = 11						
<i>Nonionella flemingi</i>	8.9	1.00	0.82	21.5	16.9	36.1
<i>Bolivina pseudoplicata</i>	5.9	0.82	0.41	8.0	5.7	19.0
<i>Elphidium charlottensis</i>	7.1	0.91	0.20	8.0	2.6	18.1
<i>Epistominella vitrea</i>	4.5	0.73	0.51	6.6	4.8	16.8
<i>Bulimina submarginata</i>	6.5	0.82	0.00	10.3	3.3	16.6
<i>Bolivina striatula</i>	3.0	0.82	0.68	3.5	2.7	16.4
<i>Notorotalia olsoni</i>	4.3	0.82	0.11	5.3	1.9	12.2

<i>Siphouvigerina glabra</i>	3.2	0.91	0.81	3.1	2.3	12.0
<i>Haynesina depressula</i>	2.7	1.00	0.33	3.6	0.1	11.5

ASSOCIATION E *Gaudryina convexa*/*Discorbis dimidiatus*

Stns. 56,57,58 = 3

<i>Gaudryina convexa</i>	9.7	1.00	0.46	22.7	18.7	35.3
<i>Discorbis dimidiatus</i>	6.3	1.00	0.53	16.0	13.5	27.2
<i>Quinqueloculina colleenae</i>	7.7	1.00	0.61	7.3	6.3	23.3
<i>Dyocibicides</i> sp.	6.7	1.00	0.46	6.7	4.9	20.2
<i>Quinqueloculina seminula</i>	7.7	1.00	0.25	8.0	3.4	19.4
<i>Miliolinella subrotundata</i>	3.0	1.00	0.33	3.3	0.3	11.8

ASSOCIATION F *Discorbis dimidiatus*/*Rosalina irregularis*

Stns. 27,29,30,31,32,33,34,48 = 8

<i>Discorbis dimidiatus</i>	6.2	1.00	0.58	7.0	4.5	20.6
<i>Rosalina irregularis</i>	5.5	0.88	0.57	7.1	5.3	19.5
<i>Elphidium charlottensis</i>	4.8	1.00	0.25	7.0	1.6	15.4
<i>Gavelinopsis lobatulus</i>	6.1	0.88	0.21	5.4	1.5	15.4
<i>Rosalina bradyi</i>	3.6	1.00	0.50	3.8	2.4	14.8
<i>Quinqueloculina seminula</i>	3.9	1.00	0.27	6.9	2.3	14.6
<i>Miliolinella subrotundata</i>	4.5	1.00	0.37	4.0	1.0	14.4
<i>Gaudryina convexa</i>	3.4	1.00	0.50	3.3	-0.7	13.3
<i>Elphidium excavatum</i> n.f.	2.1	0.63	0.48	2.3	1.8	10.4

ASSOCIATION G *Gaudryina convexa*/*Bulimina submarginata*

Stns. 25,26,35,37,38,39,41,43,45,46,49,50,51,52,53,54,55,59,60 = 19

<i>Gaudryina convexa</i>	5.2	0.95	0.56	7.2	3.2	18.7
<i>Bulimina submarginata</i>	7.1	0.95	0.19	8.4	1.4	18.0
<i>Textularia ensis</i>	4.6	0.79	0.47	5.9	3.4	16.0
<i>Quinqueloculina seminula</i>	5.4	1.00	0.34	5.5	0.9	15.9
<i>Gavelinopsis lobatulus</i>	4.9	1.00	0.41	5.1	1.2	15.8
<i>Textularia proxispira</i>	3.1	0.84	0.72	4.1	2.6	15.1
<i>Cibicides marlbroughensis</i>	2.8	0.95	0.58	3.7	1.9	14.8
<i>Dyocibicides</i> sp.	3.4	0.89	0.48	3.5	1.7	13.6
<i>Miliolinella subrotundata</i>	2.9	0.89	0.30	3.8	0.8	11.4

Subassociation G1 *Quinqueloculina seminula*/*Bulimina submarginata*

Stns. 25,37,38,39,41,43 = 6

<i>Quinqueloculina seminula</i>	8.7	1.00	0.26	8.3	3.7	21.4
<i>Bulimina submarginata</i>	7.3	1.00	0.20	7.8	0.8	18.0
<i>Gavelinopsis lobatulus</i>	6.3	1.00	0.33	6.2	2.3	17.6
<i>Quinqueloculina parvagguta</i>	5.0	1.00	0.41	4.7	3.2	16.4
<i>Cibicides marlbroughensis</i>	3.8	1.00	0.50	4.8	3.0	15.6
<i>Notorotalia olsoni</i>	4.2	1.00	0.30	5.0	1.6	14.2
<i>Bolivina spathulata</i>	3.2	1.00	0.48	2.7	1.2	13.3
<i>Hanzawaia bertheloti</i>	3.5	0.83	0.39	3.7	2.2	13.0
<i>Textularia ensis</i>	3.3	0.83	0.40	3.0	0.5	12.0
<i>Gaudryina convexa</i>	3.0	0.83	0.29	5.0	1.0	11.8

Subassociation G2 *Gaudryina convexa*/*Textularia proxispira*

Stns. 46,49,52,54,55,59,60 = 7

<i>Gaudryina convexa</i>	7.6	1.00	0.51	10.6	6.6	24.0
<i>Textularia proxispira</i>	4.3	1.00	0.58	5.0	4.0	17.3
<i>Quinqueloculina seminula</i>	6.4	1.00	0.26	6.4	1.8	17.1
<i>Pileolina zelandica</i>	4.3	1.00	0.53	4.6	3.0	16.4
<i>Dyocibicides</i> sp.	4.0	1.00	0.49	4.3	2.5	15.4
<i>Cibicides marlboroughensis</i>	3.1	1.00	0.51	3.7	1.9	14.0
<i>Gavelinopsis lobatulus</i>	3.6	1.00	0.34	4.1	0.2	12.9
<i>Textularia ensis</i>	3.7	0.71	0.29	3.7	1.2	11.6
<i>Bulimina submarginata</i>	4.9	0.86	0.05	5.0	-2.0	11.3
<i>Miliolinella subrotundata</i>	2.3	1.00	0.36	3.4	0.4	11.2

Subassociation G3 *Bulimina submarginata*/*Textularia ensis*

Stns. 26,35,45,50,51,53 = 6

<i>Bulimina submarginata</i>	9.3	1.00	0.20	13.0	6.0	24.4
<i>Textularia ensis</i>	6.8	0.83	0.41	11.3	8.8	22.5
<i>Miliolinella subrotundata</i>	5.8	1.00	0.35	6.5	3.5	17.7
<i>Gaudryina convexa</i>	4.7	1.00	0.48	5.5	1.5	16.4
<i>Textularia proxispira</i>	4.0	0.83	0.53	5.5	4.0	16.1
<i>Gavelinopsis lobatulus</i>	5.0	1.00	0.33	5.2	1.3	15.3
<i>Dyocibicides</i> sp.	4.2	0.83	0.29	4.0	2.2	13.2

ASSOCIATION H *Bulimina submarginata*/*Hanzawaia bertheloti*

Stns. 36,40,42,44 = 4

<i>Bulimina submarginata</i>	8.3	1.00	0.20	26.8	19.8	33.7
<i>Hanzawaia bertheloti</i>	7.5	1.00	0.55	8.5	7.0	23.4
<i>Anomalina spherica</i>	6.8	1.00	0.68	5.8	3.9	21.4
<i>Gavelinopsis lobatulus</i>	8.5	1.00	0.32	7.5	3.6	21.2
<i>Textularia ensis</i>	3.5	0.75	0.29	3.8	1.3	11.6

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